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ERRATA

Page	47	line 16	for 'all' 'and'	read 'most' 'or'
	49	24	,, '1.2 : 1'	,, '2.2 : 1'
	84	19	,, 'Becker (K. S.).'	,, 'Becker (K. E.).'
	104	19	,, '*Puccinastrum*'	,, '*Pucciniastrum*'
	175	13	,, 'p. 62'	,, 'p. 123'
	223	35	,, '*zonatum*'	,, '*zonale*'
	226	45	,, 'Brogdite'	,, 'Laux'
		47	,, 'laux'	,, 'brogdite'
	227	3	insert 'days' after '14'.	
	247	17	for '*somalenis*'	,, '*somalensis*'
	286	38	,, '*inodorum*'	,, '*inodoratum*'
	291	24	,, '*E.*'	,, '*Epidermophyton*'
	368	5	,, 'xi'	,, 'xii'
	396	20	,, '*oleasa*'	,, '*oleosa*'
	412	4	,, 'swede'	,, 'rape'
	414	33	,, 'Nelson (R. E.)'	,, 'Nelson (R.)'
	427	35	,, 'Johnson'	,, 'Johnston'
	435	10	,, '*vasorum*'	,, '*leptovasorum*'
	470	22	,, '*esculentum*'	,, '*esculentus*'
	514	21	,, '*zonatum*'	,, '*zonale*'
	546	9	,, '*crocorum*'	,, '*purpureum*'
	560	26	,, '*U. pančiči*'	,, '*T. pančičii*'
	598	1	,, 'Matsumoto (S.)'	,, 'Matsumoto (T.)'
	693	43	,, '*M. audouini*'	,, '*Microsporon audouini*'
	695	33	,, 'sulphuric'	,, 'sulphurous'
	696	37	,, '*Puccinastrum*'	,, '*Pucciniastrum*'
	725	22 and 31	for '*Gingko*'	,, '*Ginkgo*'
	726	15	for '*Coniothyrium*'	,, '*Coniosporium*'
		44	,, '*Puccinastrum*'	,, '*Pucciniastrum*'
	751	22	,, 'Popp (E.)'	,, 'Popp (W.)'
	782	7	,, 'the *H. brachy-*'	,, '*H.* of the *Brachy-*'
	790	18	,, '*P.*'	,, '*Phoma*'

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WOOLEY (J. C.). **The durability of fence posts.**—*Missouri Agric. Exper. Stat. Bull.* 312, 8 pp., 4 figs., 1932.

The following increases in the serviceable life of fence posts have been obtained by various fungicidal treatments carried out by the Forestry Department of Missouri University since 1913: setting in gravel, 0·63 years; charring the butt ends, 0·33; Avenarius carbolineum [*R.A.M.*, vi, p. 364], 2·4; creosote (two brush coats), 0·3; creosote (two-hour open tank), 5·7; and creosote (five-hour double tank), 7·6. Among the timber varieties responding satisfactorily to the last-named process are white cedar [*Chamaecyparis thyoides*], white oak [*Quercus alba*], red oak [*Q. rubra*], and black ash [*Fraxinus nigra*], and treatment is economically justifiable unless the initial cost of the wood is unusually low. In a test with zinc chloride (5 per cent.) and sodium fluoride (3 per cent.) started in 1927 there are two failures out of 50 posts to date with the former and 21 with the latter.

IKATA (S.) et al. **On the mode of penetration of a Peronospora species into a host.**—*Journ. Plant Protect.*, xvii, 6 pp., 5 figs., 1930. (Japanese.) [Abs. in *Japanese Journ. of Botany*, vi, 2, pp. (34)–(35), 1932.]

In hanging drop cultures of *Peronospora brassicae* [*P. parasitica*: *R.A.M.*, xi, p. 220], parasitic on *Brassica pekinensis* in Japan, the conidia produce germ-tubes which in turn give rise to vesicles (appressoria), measuring 13 to 25·6 by 10 to 16 μ, at the apex and elsewhere. Inoculated on a leaf surface, each conidium produces a germ-tube, from which a vesicle develops over a stoma and in turn emits a long hypha which enters the leaf tissues through the stoma. Cuticular infection was not observed.

HARTER (L. L.) & ZAUMEYER (W. J.). **Bean diseases and their control.**—*U.S. Dept. of Agric. Farmers' Bull.* 1692, 27 pp., 15 figs., 1932.

Popular notes are given on the symptoms, causes, and control of the more important bean [*Phaseolus vulgaris*] diseases in the United States, including anthracnose (*Colletotrichum lindemuthianum*), bacterial blight (*Bacterium phaseoli* and *Bact. medicaginis* var. *phaseolicola*), mosaic [*R.A.M.*, xi, p. 417], rust (*Uromyces appendiculatus*), curly top [ibid., xi, p. 219], powdery

mildew (*Erysiphe polygoni*), ashy stem blight (*Macrophoma* [*Macrophomina*] *phaseoli*) [ibid., ix, p. 82], and angular leaf spot (*Isariopsis griseola*) [ibid., x, p. 83]. Lima beans (*P. lunatus*) also suffer from infection by *M. phaseoli*, as well as from downy mildew (*Phytophthora phaseoli*) [ibid., ix, pp. 136, 289], pod blight (*Diaporthe phaseolorum*) [ibid., iv, p. 136], bacterial spot (*Bact. vignae*) [ibid., x, p. 537], and yeast spot (*Nematospora phaseoli*) [*N. coryli*: ibid., v, p. 390; xi, p. 638].

BRANDENBURG (E.). **Die Herz- und Trockenfäule der Rüben—Ursache und Bekämpfung.**—[The heart and dry rot of Beets—cause and control.]—*Angew. Bot.*, xiv, 3, pp. 194–228, 8 figs., 1932.

Continuing his studies at Bergen op Zoom, Holland, on the cause and control of heart and dry rot of beets [*R.A.M.*, xi, p. 147], the writer conducted a series of laboratory tests with water, sand, and sand-peat cultures, supplemented by an extensive field experiment, on the effect of boric acid and borax on the disease.

One of the three series of six sugar beet plants each in the water cultures (containing 1 mg. manganese sulphate per l.) received no boron, while the other two were given 0·7 mg. boric acid per l. The nutrient solution was that used by Zinzadze (*Landw. Versuchstat.*, cv, p. 267, 1929). As in the case of previous tests with fodder beets, the plants receiving boric acid developed well, while the others began to wilt and decay in about three weeks and ultimately died. When the boric acid supply was withheld after some weeks from one series, the typical symptoms of heart and dry rot developed, though not until the end of four to five weeks. The dry rot symptoms on the sides of the roots and discolorations of the tissue between the rings of the vascular bundles were much more marked than in fodder beets. The plants receiving a regular supply of boric acid remained completely healthy.

In the tests with sand and peat cultures the plants were grown in pure quartz sand or in sand and peat mixtures in 10 l. vessels with an inorganic nutrient medium. Boric acid at the rate of 1, 2, 5, 10, and 30 mg. was added to one lot, the two latter concentrations maintaining the plants in the mixtures of sand and peat entirely healthy, while those receiving the smaller doses gradually succumbed to the disease. In the lot in sand the plants remained healthy for ten weeks even without the addition of boron, indicating that traces of this substance were present as impurities; eventually all developed the typical symptoms, which were very slight, however, after 18 weeks in the beets receiving 30 mg. The plants in the sand and peat mixtures without boron began to wilt after four weeks. Evidently the peat binds the traces of boron in the sand in such a way as to render them unavailable for the plants. The increased yield (by weight) in the sand-peat cultures with 30 mg. boric acid amounted to 394 per cent. over that of the controls, the sugar content being 16·3 per cent. compared with 15·4 per cent. for the sand cultures with 30 mg. boric acid and 8·8 and 6·6 per cent., respectively, for those in sand-peat and sand without boron. A further test showed that the percentage increase in the

weight and sugar content of the beets in sand-peat cultures receiving 5 mg. boric acid was approximately equal with a strongly acid (P_H 5) and a nearly neutral (6·8) reaction of the medium. Symptoms of heart and dry rot were just as apparent at P_H 5 as at 6·8, indicating that alkalinity is not the primary cause of the disease.

Minute protuberances, turning from pale green to brownish-black, covered the inner side of the youngest petioles in plants suffering from a chronic form of heart rot. The roots of plants in sand without boron were almost entirely rotted.

Experiments were carried out to determine the effect of boric acid on sugar beets grown in the vessels in soil from a Silesian estate on which the disease was so severe as to cause frequent crop failures. The addition of 10 mg. boric acid per vessel increased the weight of the plants from 158·5 to 236·5 gm. and the sugar content from 17·2 to 18·18 per cent., the corresponding figures for 50 mg. being 240·7 gm. and 18·5 per cent. Field tests were conducted on the same estate, two out of six 3-are plots being given boron in the form of boric acid (2, 3, 5, 10, and 20 kg. per hect.) and four in that of borax, 1 part of the former being reckoned as equivalent to 1·5 of the latter. The substances were mixed with sand and strewn over the ground ten days after the sowing of the beets on 15th May, the field having previously been heavily fertilized. On the untreated plots the plants developed severe heart and dry rot, which had affected over 50 per cent. of the crop by 24th September. In places the foliage was completely withered, and even the healthy beets remained comparatively small. On the other hand, the plants treated with boric acid or borax, especially at the higher concentrations, developed vigorous healthy foliage and the incidence of disease was reduced from 59 to 2, 0·7, and 0·2 per cent., respectively, in the lots receiving 5, 10, and 20 kg. per hect., the figures for those to which 2 and 3 kg. were applied being 12 and 4 per cent., respectively. The highest yield was obtained from the plots receiving 3 kg. boric acid or 4·5 kg. borax per hect.—an increase of 34·8 per cent. over the untreated. The sugar content of the treated beets was increased by approximately 2 per cent. at all concentrations. In addition to these tests, three plots of 1·5 hect. each were given 9, 20, and 30 kg., respectively, of borax while two strips of 1 hect. each traversing the entire field were left untreated. Here again the treated plants remained practically free from heart and dry rot, which occurred in a fairly severe form over the areas receiving no borax. By the end of September the average incidence of the disease in all the treated plots was only about 4 per cent.

Analyses showed that the boric acid content of the ash of healthy beets was 0·360 to 0·442 per cent. compared with only 0·105 to 0·287 per cent. in diseased ones. The ash content of severely diseased beets was much higher than that of the healthy (6·01 per cent., compared with 1·91 and 2·26 per cent. in the plots receiving 20 and 30 kg. borax, respectively).

Tomato and potato plants grown in a nutrient solution to which boric acid (0·5 mg. per l.) was first applied and then withheld developed various abnormalities of growth and discoloration of the

vascular bundles of the stalks and petioles, which were absent from those receiving a regular supply of boric acid. Similar results were obtained by E. S. Johnston (*Soil Sci.*, xxvi, p. 173, 1928), also in collaboration with P. L. Fisher (*Plant Physiol.*, v, p. 387, 1930).

The application of the data yielded by the beet experiments to practical cultivation is discussed. Probably the best results would generally be given by an early application of boron, at the time of sowing or a little later, with one or more repetitions during the summer. Further investigations are necessary to determine the requisite amounts to be given under varying soil and climatic conditions.

Du Plessis (S. J.). **White mould in Onions.**—*Farming in South Africa*, vii, 75, pp. 112–114, 2 figs., 1932.

A popular account is given of the white mould of onions which has long been known in South Africa, though its causation by *Sclerotium cepivorum* [*R.A.M.*, xi, p. 219] has only recently been established there. The disease has so far been reported only from Stellenbosch, Caledon, Wolseley, and Villiersdorp.

White mould is favoured by low temperatures (10° to 20° C.) and a medium moisture content. The sclerotia may persist in the soil and in onion refuse for a number of years (four or more), so that prolonged crop rotation is essential for the control of the disease. The sclerotia succumbed to immersion in 0·1 per cent. mercuric chloride for 15 to 20 minutes, and also to 45 minutes' heating at 100°, but these measures, as well as disinfection of the soil by formalin, are impracticable on a large scale. Brief indications are given of cultural methods likely to bring about a reduction in the incidence of infection.

Lauritzen (J. I.). **Development of certain storage and transit diseases of Carrot.**—*Journ. Agric. Res.*, xliv, 12, pp. 861–912, 1 graph, 1932.

This is a detailed and fully documented account of the author's investigation under controlled conditions of the influence of external factors, chiefly temperature and air humidity, on the incidence and development of storage and transit rots of carrots in the United States, caused by *Sclerotinia sclerotiorum*, *Rhizopus tritici* and *R. nigricans* (the only two species of this genus which appear to occur on carrots under normal Washington conditions) [cf. *R.A.M.*, iii, p. 546], *Botrytis cinerea*, and *Bacillus carotovorus*. The results indicated that the safest environmental conditions for the storage of carrots are a temperature of 0° C. and a relative humidity of 90 to 95 per cent.

In tests designed to ascertain the varietal resistance of carrots to the various rots, 14 varieties were found to be susceptible to infection with *S. sclerotiorum*, 16 with *R. tritici*, 17 with *B. carotovorus*, and 18 varieties with *Botrytis cinerea*, and no significant differences were found in their relative resistance. At temperatures ranging from 0° to 15·5° C. most of the varieties were also susceptible to rotting by *Fusarium* and *Penicillium* spp.

DORAN (W. L.). **Downy mildew of Cucumbers.**—*Massachusetts Agric. Exper. Stat. Bull.* 283, 22 pp., 1932.

A full account is given of the writer's studies on downy mildew of cucumbers (*Peronoplasmopara* [*Pseudoperonospora*] *cubensis*) in Massachusetts, where the disease is stated to be common and severe on all field and greenhouse varieties. The organism from cucumber was shown to infect muskmelon, but not squashes, pumpkin, or watermelon. Cucumbers are in no danger of infection from weed hosts in the State. The youngest leaves were found to be resistant.

No overwintering stages of the fungus have been found, and the inoculation of plants with material overwintered in the soil did not produce infection. All available evidence suggests that downy mildew reaches Massachusetts from southern States through the gradual northward movement of spores borne by the wind [*R.A.M.*, xi, p. 496].

Conidial germination took place at a temperature range of 9° to 30° C., with an optimum at 16° to 19°. Two to three hours on a wet leaf is sufficient for germination, and zoospores may be emitted and cause infection within five hours. The conidia remained viable for 50 hours in moist air. Infection usually results in sporulation within six to nine days, dew providing enough moisture for the process. Sulphur was more effective than copper-lime dust in preventing sporulation [ibid., xi, p. 421], the conidia being killed by contact with dry sulphur for five hours at 22°. Sulphur was not toxic, however, to the conidia in water, and infection was not prevented when the latter fell on dusted leaves. Sulphur not only failed to give protection in the field but was definitely injurious to the plants. Both in the field and greenhouse copper fungicides are therefore preferable, Bordeaux mixture 3–3–50 being recommended for the former and 1–1–50 for the latter.

HAYES (T. R.). **Groundnut rosette disease in the Gambia.**—*Trop. Agriculture*, ix, 7, pp. 211–217, 4 figs., 1932.

In noting the increasing economic importance of groundnut rosette disease in the Gambia [*R.A.M.*, xi, p. 697], the author describes at some length three types of the trouble observed by him, all of which have been shown to be transmissible by grafting, though proof has not yet been obtained that any particular insect can carry them in the Gambia. The first type, termed 'chlorotic rosette', is by far the most common; it usually shows up first at the tip of a lateral shoot, the young leaves of which are flaccid and soon develop small light yellow patches, which in time become green but of a slightly paler shade than normal. The next pair of leaves usually exhibit light yellow and pale green spots which do not turn greener, while the remainder of the leaves assume a darker green than normal. The affected leaves are narrower and more pointed than the healthy, and those that develop about two weeks after infection are much smaller than usual, and crinkled. As the disease develops the petioles on the affected parts become progressively shorter, until finally the leaves are almost sessile; a similar shortening also occurs in the internodes. The flowers of diseased plants are reduced in size, sessile, and fail to open.

The second (green rosette) type usually occurs in small groups only, and is rather infrequent; it differs from the first in that it is not accompanied by chlorosis, the whole of the diseased leaves being of a darker green than normal; the leaves are shorter but not narrower than usual, giving them a roundish appearance; and in contrast to plants affected with chlorotic rosette, green rosetted plants do not flower more profusely than normal. Grafting experiments appeared to indicate that these two types are caused by two distinct virus entities. In the third type (rosette type 3) the leaves are normal in colour, but much smaller and thicker; the stems are also considerably thickened, and the branches curve in a clockwise direction. Only two plants of this type were observed, but it is pointed out that the lack of distinction in the colouring of the healthy and diseased leaves renders the trouble easy to overlook.

Observations of the behaviour of the rosette disease in native fields, supported by preliminary experiments, have shown that late groundnut plantings are more susceptible to it than early sowings; wide spacing of the plants gives more disease than close planting; plants growing on the border of the plots are more liable to be infected than those in the middle; and a cover of weeds (particularly of the grass *Digitaria marginata*) tends to reduce the incidence of the disease, presumably by protecting the soil from evaporation, since there was evidence that in the Gambia the disease is associated with periods of drought. In the author's opinion these observations supply a possible line of attack on the trouble, by correspondingly altering the agricultural practices now in force among the natives.

Du Plessis (S. J.). **Anthracnose of the Vine.**—*Farming in South Africa*, vii, 75, p. 104, 1932.

Among the vine varieties observed to be highly susceptible to anthracnose (*Gloeosporium ampelophagum*) in South Africa are Appley Towers, Carignan, Muscadel, Ohanez, Sultana, and Waltham Cross, while Ferdinand de Lesseps, Golden Queen, and Shavoah are extremely resistant. Very resistant varieties further include Black Hamburg, Formosa, Hermitage, and Raisin Blanc, while a number of others [which are listed] are intermediate in their reaction.

The control of the disease should be based on thorough sanitation, supplemented by a dormant treatment of the vines with 1 in 8 lime-sulphur or 4 per cent. sulphuric acid, and three or more applications of Bordeaux mixture 4–4–50, (*a*) when the young shoots are 6 to 10 in. long; (*b*) when the flowers drop; and (*c*) at fortnightly intervals under humid conditions.

Report on the work of the North of Scotland College of Agriculture for the year 1930–31.—30 pp., Aberdeen Journals, Ltd., 1931.

The following items of phytopathological interest occur in this report. W. M. Findlay states that, in addition to the Bruce turnip [*R.A.M.*, x, p. 637; xi, p. 759], a Swedish variety called Wilhelmburger and a strain of the Danish Bangholm proved relatively

resistant to finger-and-toe [*Plasmodiophora brassicae*: ibid., ii, p. 151; x, pp. 283, 574]. A selection from the Bruce, known as the Wallace, appears to be equally resistant with the parent variety.

According to D. Clouston the 'Lanarkshire' strawberry disease [or 'red core' (*Phytophthora* (?) *cinnamomi*): ibid., ix, p. 795], which has reduced the area of profitable cultivation in the Clyde Valley from 1,500 to 500 acres, has now appeared in the Aberdeen district.

Report of the Agricultural Faculty for the year 1930–31.— University College, Dublin, 14 pp., 1932.

In the section of this report dealing with plant pathology it is stated that the work on the production of virus-free stocks of potato varieties [at the Glasnevin Station] has been successfully prosecuted during the year under review.

Unfavourable weather conditions reduced the prevalence of dry rot [*Phoma lingam*: *R.A.M.*, ix, p. 218] of swedes. Accumulating evidence tends to implicate the remains of the old crop in the fields as the more usual source of infection. Although the seed is sometimes also responsible [cf. ibid., xi, p. 345], a very thorough examination of a number of commercial samples showed that many, if not most of them, were practically or completely free from infection. The possibility of cruciferous weeds being a contributory source of infection is being studied.

For the purpose of the further study of the overwintering and transmission of stem rust of oats [*Puccinia graminis avenae*: ibid., xi, p. 362], a large collection of species of *Berberis* was established; while a number of species and hybrids were found to be susceptible to the rust, the balance of evidence indicated that none of these is likely to be of practical importance except the highly susceptible common barberry, from which the rust spread to a slight extent to plots at Glasnevin of pedigree stocks of oats growing about a mile westward of the barberry garden. This is stated to be the first record of the rust in that locality.

MARCHAL (E.). **Recherches et observations effectuées à la Station de Phytopathologie de l'État pendant la période 1927–1931.** [Researches and observations carried out at the State Phytopathological Station during the period 1927–1931.]—*Bull. Inst. Agron. et des Stat. de Recherches de Gembloux*, i, 3, pp. 164–174, 1932. [Flemish, German, and English summaries.]

This report, which is on the same lines as that previously issued [*R.A.M.*, viii, p. 704], contains among others the following items of phytopathological interest.

Black chaff (*Bacterium translucens* var. *undulosum*), first recorded on wheat in Belgium in 1929 [ibid., ix, p. 768], has also attacked spelt wheat. A tobacco disease closely resembling wildfire [*Bact. tabacum*: ibid., x, p. 62] was observed in the valley of the Semois [ibid., x, p. 503]. Hothouse palms developed a canker at the base of the pseudostem near the collar, associated in some instances with a *Nectria* and in others with *Colletotrichum*

allescheri; other hothouse palms showed a rot of the terminal bud due to a *Pythium* or a *Phytophthora*.

Other records included *Sphaeropsis malorum* [*Physalospora cydoniae*] on apple branches, *Phacidiella discolor* killing pear branches [ibid., vii, pp. 646, 700], *Verticillium albo-atrum* causing apoplexy of plums [cf. ibid., v, p. 586; x, p. 150] in the valley of the Meuse, and a red spotting of the pericarp of gooseberries due to *Corticium centrifugum* [ibid., x, p. 38].

FAES (H.). **Station fédérale d'essais viticoles à Lausanne et Domaine de Pully. Rapport annuel 1931.** [Annual report for 1931 of the Federal Viticultural Experiment Station at Lausanne and Domaine de Pully.]—*Ann. Agric. de la Suisse*, xxxiii, 3, pp. 153–169, 9 figs., 1932.

This report, which is on the same lines as those for previous years [cf. *R.A.M.*, xi, p. 24], contains among many others the following items of phytopathological interest.

Owing to the low temperatures that prevailed, downy mildew of the vine [*Plasmopara viticola*] did not cause much damage in the vicinity of Lausanne in spite of heavy rains during July and August, 1931; energetic control measures were effected, seven applications of Bordeaux mixture and two of sulphur dust being given in the Domaine de Pully.

Further investigations into coître (*Coniothyrium diplodiella*) definitely established the fact that the fungus retains its germinative capacity and virulence for at least twelve years [ibid., xi, p. 692]. Late scab (*Venturia*) [*inaequalis*: ibid., x, p. 801] on harvested apples [see below, p. 32] was definitely reduced by spraying the trees with lime-sulphur mixtures late in the season (up to 15th September) to prevent infection of fruit still on the trees. Wrapping the fruit in oiled paper or silk was quite unavailing, even when the apples were buried in peat. Numerous rot-producing fungi (*Penicillium*, *Botrytis*, and *Gloeosporium* spp.) were found to effect an entry into stored apples in January and February through lesions caused by scab. The incubation period of the mycelium of *V. inaequalis* in affected apples in storage may extend to one month or six weeks.

MCDONALD (J.). **Annual Report of the Senior Mycologist for 1931.**—*Ann. Rept. Dept. of Agric. Kenya for the year ended 31st December, 1931*, pp. 118–130, 1932.

In laboratory cultural work on the strains of *Colletotrichum coffeanum* [*Glomerella cingulata*] which in Kenya Colony cause, respectively, coffee berry disease [*R.A.M.*, xi, p. 159] (the major disease of coffee in the Colony, where the losses sustained from it are considerable), brown blight, and scab (an intrinsically unimportant, extremely superficial, small buff spot on green coffee berries, affecting only small portions of the pulp), mutations of all these strains were obtained, but in no instance did the brown blight strain or the scab strain give rise to that causing berry disease. The coffee bug (*Antestia lineaticollis*) was prevalent in several localities in which the internal coffee bean rotting due to *Nematospora coryli* was commonly found [ibid., xi, p. 698].

A new physiologic form, K4 [see below, p. 13], of wheat black rust [*Puccinia graminis*: ibid., x, p. 296; xi, p. 159] was found at Ula in June and at Nairobi in August, to which Kenya Governor and Kenya Standard wheats were susceptible under favourable conditions.

Black chaff [*Bacterium translucens* var. *undulosum*: see below, p. 13] appears to be present in many parts of Kenya. Take-all (*Ophiobolus graminis*), recorded in Kenya for the first time in the period under review, was present at altitudes of over 8,000 ft.; it persists in the soil on grasses and cereals, but in the absence of these hosts it does not survive long. Root disease of wheat (*Helminthosporium sativum*), also a new record, was associated with numerous species and strains of weakly parasitic fungi.

Fusarium moniliforme var. *conglutinans* was commonly present in root, stalk, and ear rots of maize: many strains and possibly several species of *Fusarium* were associated with ear and root rots of this host.

Pythium aphanidermatum was isolated from sixteen months-old sisal [*Agave rigida* var. *sisalana*] showing shrinking and blue discoloration of the leaf bases; the affected plants had been subjected to waterlogged soil conditions during a period of exceptionally heavy rainfall the previous year.

Bacterial blight of beans [*Phaseolus vulgaris*], due probably to *Bacterium phaseoli* [ibid., xi, p. 618 and above, p. 1], was recorded for the first time.

During the height of an invasion by locusts (*Locusta migratoria migratorioides* Rch. & Frm.) many of the insects were killed off by *Empusa grylli* Fresen. [ibid., viii, p. 380].

The prohibition of the cultivation of all sugar-cane varieties other than Uba in force for three years in the Kisuma-Londiani area on account of mosaic [ibid., v, p. 576: vii, p. 12] was allowed to lapse, growers being advised, however, to restrict their planting to P.O.J. canes.

New records other than those noted above included *Ganoderma lucidum* on living plum trees [cf. ibid., x, p. 138], *Corticium salmonicolor* on orange [ibid., viii, p. 549], and *Septoria* [*Mycosphaerella*] *rubi* on raspberries.

LEACH (R.). **Report of the Mycologist.**—*Ann. Rept. Dept. of Agric., Nyasaland, 1931*, pp. 47–50, 1932.

During the period under review most of the plant disease research work conducted in Nyasaland was confined to further investigations of tea diseases [cf. *R.A.M.*, xi, p. 805].

'Gnarled' canker is now suggested as a more appropriate name for the condition hitherto known in Nyasaland as stem canker, which resembles the Indian disease of the same name but differs from the form of stem canker found in Ceylon. It occasionally causes trouble in the field, but is more serious in the nurseries, where its incidence appears to be correlated with certain soils.

The sporing stage of the organism causing violet root disease of tea [ibid., viii, p. 203] was discovered and proved to be more closely related to *Helicobasidium compactum* Boedijn [ibid., x, p. 562] than to *H. longisporum* which had been previously

suggested [ibid., x, p. 707]. The fructification is a flat, velvety growth a few mm. thick, girdling the stem and occasionally the lower branches and leaves a few inches from the ground. It is entirely superficial. During the dry season the surface remains sterile, but when the rains begin the fungus grows a new mat superimposed on that of the previous season. Before sporulation starts the new growth shows up distinctly in purple patches with a faint brown tinge against the background of the old tissues. As the plants show no apparent sign of violet root until it is too late to apply soil disinfectants, and as infection is generally so unevenly distributed through the nurseries that systematic trenching is impracticable, once the disease has appeared control is very difficult. If, however, an isolated area of affected bushes is present, a trench should be dug round it, care being taken to leave a wide margin of plants which while apparently healthy may be affected in the roots. In a patch of uncleared forest surrounding a nursery which had been severely attacked the previous year threads of the violet root fungus were found on various living roots; two or three plants of one [unnamed] species had been killed by the fungus, the roots being dry and brittle and covered with a purple mat of hyphae with distinct infection cushions.

The root disease of tea caused by *Armillaria* [*mellea*: ibid., viii, p. 202] is a constant source of trouble in Nyasaland, especially on newly opened land. It is more difficult to control in young clearings than in old ones, probably because in the latter the roots of the original forest trees have for the most part decayed. In old tea gardens the disease spreads slowly, and besides digging out the dying plants, a trench should be made round the diseased patches, leaving a margin inside of at least one row of apparently healthy plants. The roots left in the soil during clearing are a constant source of infection to the young tea until they are destroyed by desiccation and should be dug out and burnt if they start the disease.

The 1931 season was marked by severe drought, and some tea plants, especially those rather heavily pruned, suddenly died after coming away well from pruning; the roots of all these were extensively penetrated by *Rhizoctonia bataticola* [*Macrophomina phaseoli*].

The under surface of the leaves of green gram (*Phaseolus mungo* var.) showed dark brown, angular, interveinal spots consisting of a velvety growth of a fungus resembling *Heterosporium*; the conidiophores measured 90 μ in length, and the elongated, 1- to 5-septate, slightly constricted, light brown conidia were 34 to 45 by 7 μ. Growth in cultures was exceedingly slow.

Chindumba plants (*Echinochloa frumentacea*) [*Panicum frumentaceum*] were attacked by a fungus resembling both *Ustilago panici-frumentacei* and *U. paradoxa*, and possibly a hybrid.

Lemon trees were attacked by collar crack due to *Armillaria* [*mellea*].

[Martyn (E. B.).] **Botanical and mycological investigations.**—*Admin. Rept. Director of Agriculture British Guiana for the year 1931*, pp. 27–28, 1932.

In 1931, a non-infectious chlorosis slightly affected a few seed-

ling sugar-canes in the Corentyne district of British Guiana ; the condition resembled that attributed in other countries to manganese deficiency. Inoculation experiments with the *Fusarium* associated with the rice disease known locally as ' man rice ' [*R.A.M.*, x, p. 361] showed that it is able to kill seedling plants under conditions favourable to the fungus. The disease is less severe than the apparently similar one reported from Madras [ibid., x, p. 336].

SHERBAKOFF (C. D.). **Plant pathology.**—*Forty-fourth Ann. Rept. Tennessee Agric. Exper. Stat. for 1931*, pp. 50–54, 1932.

Four applications of 2–4–50 Bordeaux mixture, beginning about 1st May, gave as good control of cherry leaf spot [*Coccomyces hiemalis*: *R.A.M.*, x, p. 741] as seven, lime-sulphur and flotation sulphur being less effective.

The omission of sulphur from early peach sprays was found to increase the risk of scab [*Cladosporium carpophilum*]. The use of lead arsenate with flotation sulphur, either without lime or with the same amount of lime as of sulphur, caused foliage injury in peaches which was noticeably severe on poorly developed trees. The application to peaches of a sulphur spray without lead arsenate shortly before harvest gave temporary protection against brown rot [*Sclerotinia americana*: ibid., xi, p. 661].

A species of *Cercospora* (? *C. nicotianae*) was isolated from spherical green spots, about $\frac{1}{4}$ in. in diameter, on cured Burley tobacco leaves. As a rule this trouble is of minor importance, but in 1931 the spotting was extensive.

In the section on horticulture (pp. 48–50), B. D. Drain states that *Pyrus calleryana* continued to resist fireblight [*Bacillus amylovorus*: ibid., viii, p. 292] and may be used as a stock for susceptible pear scions.

S. H. Essary gives a note (in the botany section: pp. 26–34) on the methods of testing red clover [*Trifolium pratense*] for resistance to anthracnose [*Kabatiella caulivora*: ibid., xi, p. 768], studies on the inheritance of which are in progress.

Experiments in the control of tomato leaf spots [*Septoria lycopersici* (ibid., iv, p. 336) and other fungi] indicated that good results may be obtained by seed-bed and cold frame soil disinfection with 1 per cent. acetic acid, supplemented by spraying with 5–5–50 Bordeaux mixture or dusting with copper-lime, the latter giving the larger yield of fruit. No sign of resistance was given by any of the varieties used in the tests, namely, Marglobe, Tennessee Pink, Tennessee Red, Gulf State, Break o' Day, and Norduke, and little is to be expected from selection for this purpose.

A year's progress in solving farm problems of Illinois 1930–31.—*Forty-fourth Ann. Rept. Illinois Agric. Exper. Stat. for year ended June 30, 1931*, 304 pp., 45 figs., 15 diags., 6 graphs, 1931. [Received November, 1932.]

The following are a few of the references of phytopathological interest in this report. Ear rot of maize was found by B. Koehler to be three times as severe (17·3 per cent.) in sowings made on 31st May as in those on the 1st (5·4). The losses from ear rots

have averaged 7·5 per cent. of the crop in the Station farm investigations for the seven years from 1924 to 1930 and were 9·4 per cent. in the last year, primarily due to *Diplodia zeae* and *Fusarium moniliforme* [*Gibberella moniliformis*], the latter being responsible for the increased infection in late sowings [*R.A.M.*, x, p. 644]. Artificial drying of maize seed-grain in the Carrier air-conditioning apparatus at 110° and 130° F. was found to kill 90 per cent. of the *G. moniliformis* present, without injuring *D. zeae* or *Penicillium*.

It has again been found advisable in H. W. Anderson's tests to substitute flotation sulphur for lime-sulphur in the apple scab [*Venturia inaequalis*] schedule where the latter preparation is liable to cause injury [see below, p. 29]. but under ordinary conditions lime-sulphur may safely be used for the pre-bloom applications. V. W. Kelly and M. D. Farrar found that serious yellowing of Delicious and Jonathan apple foliage followed the application of a 2 per cent. saturated oil of 83 viscosity.

H. W. Anderson reports a continuous increase in the prevalence of apple measles [ibid., xi, p. 248] on the Red and Golden Delicious, Starking, Wealthy, Jonathan, and Grimes varieties. In one orchard 25 per cent. of the trees died from this cause within two years after planting.

In addition to the Lloyd and Blair Forcing tomato varieties [ibid., x, p. 416], No. 1001 (a cross between Grand Rapids Forcing and Marglobe) has shown resistance to wilt [*Fusarium lycopersici*] in the tests of W. A. Huelsen, M. C. Gillis, and W. H. Michaels, while C. E. Durst has obtained good results with Century.

Plant pathology.—*Forty-fourth Ann. Rept. Arkansas Agric. Exper. Stat. for the year ending June 30, 1932* (*Bull.* 280), pp. 54–58, 1932.

The following items of interest, in addition to those already noticed from other sources, occur in this report. According to W. H. Young and C. K. McClelland, complete control of oat smut [*Ustilago avenae*] was obtained by treatment of the seed-grain with iodine dissolved in carbon disulphide [*R.A.M.*, x, p. 22].

Seedling blight of rice (*Helminthosporium oryzae*) [*Ophiobolus miyabeanus*: ibid., xi, pp. 159, 536] was found by E. M. Cralley to be most severe at a temperature range of 18° to 22° C. In experimental plots the most serious damage occurred on plants sown during the latter part of April, when the soil temperatures are still relatively low. All varieties so far tested, including Early Prolific, Fortuna, Rexora, Supreme Blue Rose, Edith, and Calora Japan, are susceptible to *H. oryzae*. The first four varieties, together with Honduras and Lady Wright, are also susceptible to stem rot (*Sclerotium oryzae*), to which some of the less productive foreign sorts, such as Aikoku, Kameiji, and Spain Jap, are fairly resistant. Regular flooding treatments have given satisfactory control of this disease.

Only one live pear bud out of several hundreds examined by H. R. Rosen was found to contain viable blight (*Bacillus amylovorus*) bacteria after overwintering [ibid., xi, p. 160]. As in previous years, no infectious exudate from overwintered cankers

was found in 1932 before the appearance of the first spring blight [cf. ibid., xi, p. 111]. Assuming that the honey bee is at least partially responsible for the initial dissemination of blight on blossoms, a weak Bordeaux mixture has been applied during the past few years to fully open flowers with promising results. Further studies on an apple and pear disease simulating fireblight and characterized by blighting of blossoms and (in artificial inoculations) of twigs, and leaf spotting, indicated that a different bacterial pathogen is responsible for these symptoms.

BURTON (G. J. L.). **Annual Report of the Senior Plant Breeder for 1931.**—*Ann. Rept. Dept. of Agric. Kenya for the year ended 31st December, 1931*, pp. 176–201, 1932.

In a comparative yield test of wheat varieties carried out during the period under review at the Njoro Plant Breeding Station, Kenya, all the plants of every variety used were destroyed by black chaff [*Bacterium translucens* var. *undulosum*: *R.A.M.*, xi, p. 163], the grain being so shrivelled that it could not be threshed. Take-all [*Ophiobolus graminis*] has spread considerably at the higher altitudes in Kenya, and in 1931 seriously reduced the yields.

A table is given showing the reaction of ten wheats grown in Kenya to the four physiologic forms (K1, K2, K3, and K4) of black rust [*Puccinia graminis*] now known to be present in the colony [see above, p. 9]. Of the crosses made to improve the milling standard while retaining resistance to black rust and yellow rust [*P. glumarum*], the most important families at the Njoro Station are Nos. 117, 122, 112, 135, 136, 143, and 130, No. 112 being perhaps the most promising. It is thought that the inheritance of resistance to form K2 is not dependent on a single factor as is the inheritance of resistance to forms K1 and K3, so that it is difficult to obtain resistance to all the forms together. These new wheats would be suitable for all districts in Kenya except those with two short rainy seasons. Field experiments in 1930 and 1931 showed clearly that more than one physiologic form of leaf [brown] rust [*P. triticina*] is habitually present in Kenya and that Kenya Standard wheat is susceptible to them, while B. F_4. 3. B. 10. V. 1 (L) is resistant. Crosses (now in the F_4 generation) between these two wheats have given several very resistant forms and as Kenya Standard is resistant to all four forms of black rust, these crosses are being fully tested at the Scott Agricultural Laboratories Plant Breeding Station, where the work is mainly to improve on Kenya Standard in regard to resistance to brown rust, yield, and grain quality.

The maize breeding to be carried out by C. Maher at Trans Nzoia is expected to produce more definite results than that hitherto conducted in Njoro, as the objects of the work in the former locality are more definite (studies of resistance to *Helminthosporium turcicum* [ibid., x, p. 297] and *Fusarium* diseases) and the ordinary mixed maize crop is more susceptible to these fungi there than elsewhere. The material available at Trans Nzoia at the beginning of the 1931 season included 17 self-fertilized cobs resistant and 4 susceptible to *H. turcicum*.

NEWTON (MARGARET) & JOHNSON (T.). **Studies in cereal diseases. VIII. Specialization and hybridization of Wheat stem rust, Puccinia graminis tritici, in Canada.**—*Canada Dept. of Agric. Bull.* 160, N.S., 60 pp., 16 figs., 7 diags., 4 graphs, 1 map, 1932.

Most of the information in this paper is based on investigations previously reported in connexion with the specialization and hybridization of wheat stem rust (*Puccinia graminis tritici*) in Canada [*R.A.M.*, xi, pp. 437–439, *et passim*].

During the period from 1919 to 1930, 41 physiologic forms of the rust were isolated from cereals and grasses. Until 1926 all the forms found were identified as one or other of those described in the United States by Stakman and his collaborators, but since that year a number of distinct forms have been isolated in Canada. Different physiologic forms have been shown to predominate in different years. Thus, from 1919 to 1921, form 17 was the most prevalent, 21 occurring seldom, whereas from 1922 to 1929 the reverse was the case. Other forms, e.g., 24, appeared once or twice and then remained absent for a number of years, while 11 developed so consistently over a long period as to be regarded as semi-permanent and then suddenly disappeared for a considerable time. Since 1925 form 36 has predominated. Most of the damage to Canadian wheat seems to be caused by forms 36 and 21, which comprised over 50 per cent. of the 2,171 isolations made during the period under review, while 38, 17, and 49 are also involved to a lesser extent. All these forms are characterized by long uredospore-producing periods and consequently have a much better chance of survival than those with correspondingly short periods, such as forms 83, 53, 48, and 33.

In Eastern Canada and in British Columbia, where barberries are fairly common, a proportionately larger number of new physiologic forms have been isolated than in the great central wheat plain of the prairie Provinces, which contains practically no barberries. Some correlation was also observed between the introduction of new varieties of wheat into a district and the occurrence in the latter of physiologic forms not previously found there.

A temperature of 65° F., in conjunction with a moderate light intensity such as prevails in spring and autumn, has been found satisfactory for the testing of physiologic forms of *P. graminis tritici* with a view to their determination.

Although the Mendelian laws of inheritance appear to be operative in all the crosses between physiologic forms of the rust investigated, considerable evidence is available that in some of these the cytoplasm of the parent forms influences the inheritance of pathogenicity.

COTTER (R. U.). **Factors affecting the development of the aecial stage of Puccinia graminis.**—*U.S. Dept. of Agric. Tech. Bull.* 314, 37 pp., 5 pl., 1932.

A comprehensive account is given of the writer's studies in Minnesota on the factors affecting the development of the aecidial stage of wheat stem rust (*Puccinia graminis tritici*).

A list is given of the susceptible and immune species and varieties of *Berberis*. A correlation was indicated, in the progeny of a cross between *B. vulgaris* and *B. thunbergii*, between the inheritance of some morphological characters of the former and susceptibility to *P. graminis* [*R.A.M.*, xi, p. 628].

The teleutospores of the rust were found to remain viable for at least 18 months under dry conditions at a temperature near freezing-point; they very rarely germinate above 26° C., and a range of 12° to 21° gave the most favourable results in teleutospore germination, barberry infection, and aecidial production.

The minimum period required for barberry infection by teleutospores was 21 hours, except in a moist chamber where exposure to a shower of sporidia resulted in infection in five hours. The leaves (up to 16 days old), stems, spines, petioles, sepals, and berries of *B. vulgaris* are all liable to infection.

The aecidia of *P. graminis* may discharge aecidiospores 37 days after their formation, and the aecidiospores are capable of infecting rye up to 46 days after the first appearance of the aecidia.

A study of the physiologic forms of *P. graminis tritici* isolated from *Berberis* spp. (including *B. canadensis* and *B. declinata* [var.] *oxyphylla*) inoculated with teleutospores from Red Sask wheat showed that forms 18 and 35 were associated five times, 21 and 33 four times, 18 and 33 twice, 21 and 35 three times, and 34 and 35 once. Forms 34, 36, 51, and 52 appeared only once in the course of the investigations [cf. preceding abstract].

HASSEBRAUK (K.). **Zur Bewertung der Saugkraft als Merkmal von Braunrostbiotypen.** [On the utilization of osmotic force as a character of brown rust types.]—*Phytopath. Zeitschr.*, v, 2, pp. 173–177, 1932.

In order to test the validity of Steiner's conclusions as to the importance of the osmotic force of the uredospores of brown rust of wheat (*Puccinia triticina*) as a differential character of the various physiologic forms [*R.A.M.*, ix, p. 705], the writer repeated the experiments during 1931–2 with the same forms (XI, XIII, and XIV) under identical conditions, except that fresh uredospores were used instead of stored ones.

The spores were germinated in cane sugar solutions of 0·3 to 0·6 mol., and also in water for control purposes, on three dates each in November and February and on one in March. The average germination of form XI at 0·3 and 0·6 mol. throughout the period was 67·1 and 10·7 per cent., respectively, compared with 73·5 per cent. in water, the corresponding figures for XIII being 49·4, 3·7, and 67·7 per cent., respectively, and for XIV, 59·8, 7·6, and 70·5 per cent., respectively. These figures differ widely from those obtained by Steiner, who also found that the maximum sugar concentration permitting germination was 0·55 to 0·6 mol., whereas in the present tests the limit was near 0·65; according to Stock [ibid., x, p. 587], isolated germination occurs in a 1 mol. glucose solution. In view of these discrepancies it is held that the osmotic force of the uredospores is not a reliable criterion for the differentiation of the physiologic forms of *P. triticina*.

SCHILCHER (E.). **Über die Lebensdauer der Uredosporen Puccinia triticina.** [On the longevity of the uredospores of *Puccinia triticina*.]—*Zeitschr. für Pflanzenkrankh. u. Pflanzenschutz.*, xlii, 9, pp. 465–467, 1932.

The results [which are briefly described] of germination tests with the uredospores of brown rust of wheat (*Puccinia triticina*) in the laboratory at the Vienna Plant Protection Institute (temperature range 9° to 22° C.), showed that the viability of material collected in September is fully maintained for at least six months, whereas in the spring and early summer the spores lose their power of germination after three months [*R.A.M.*, xi, p. 32]. The tests were carried out by using spore material, collected from a number of different localities and kept in dry Petri dishes protected from direct sunlight, to inoculate wheat.

SEIDLER (F.). **Selbstanfertigung eines Trockenbeizapparates.** [A home-made dusting apparatus.]—*Wiener Landw. Zeit.*, lxxxii, 33, p. 259, 2 diags., 1932.

A satisfactory dusting apparatus for the disinfection of cereal seed-grain may be constructed with a calcium cyanamide drum of corrugated tin encircled round the middle of the long axis by two half-hoop iron bands, one of which is bent out at the ends to form supports enabling the drum to be revolved on a median axis parallel with the ends of the cylinder. A crank is affixed to one of the drawn-out ends of the encircling band and the entire machine is mounted on a strong wooden block. The capacity of a drum of this type is 25 kg. and the mixing process takes about five minutes.

Die Beizung des Saatgutes. [Seed disinfection.]—*Wiener Landw. Zeit.*, lxxxii, 33, p. 259, 1932.

Attention is drawn to the great value of ceretan as a disinfectant dust for the control of seed-borne diseases of cereals in Austria, e.g., *Fusarium* [*Calonectria graminicola*] of rye, wheat bunt [*Tilletia caries* and *T. foetens*], and barley stripe (*Helminthosporium gramineum*). This preparation is officially recommended by the Federal Institute of Plant Protection for use at the following rates: 100 gm. per kg. for wheat, beans, and peas, 150 gm. for barley and spelt, 200 gm. for oats, and 300 to 400 gm. for beet.

HÜTTIG (W.). **Die Grundlagen zur Immunitätszüchtung gegen Brandpilze (Ustilagineen). (Sammelreferat.)** [The foundations for breeding for immunity from smut fungi (Ustilagineae). (A comprehensive survey.)]—*Der Züchter*, iv, 9, pp. 209–219, 24 figs., 3 graphs, 1932.

A résumé is given of the principal recent studies forming the basis of breeding for immunity from various cereal smuts. Most of the papers cited have been noticed in this *Review*.

HÜTTIG (W.). **Über den Einfluss der Temperatur auf die Keimung und Geschlechtverteilung bei Brandpilzen.** [On the

influence of temperature on germination and sex distribution in the smuts.]—*Zeitschr. für Bot.*, xxiv, 10–11, pp. 529–557, 26 figs., 1931.

The author has tested the effect of temperature on the germination of nine species of *Ustilago*, including *U. avenae*, *U. hordei*, *U. nuda* f. sp. *tritici* [*U. tritici*] and *U. zeae*. *U. avenae* failed to germinate in seven days at −1° C., germinated to the extent of 2 per cent. at zero, and increased to 98 per cent. at the optimum at 20°, falling to 60 per cent. at 30° and failing to germinate at 35°. *U. hordei* gave 30 per cent. germination at −1°, 99 per cent. at 10°, 50 per cent. at 30°, and failed to germinate at 35°. *U. tritici* agreed with *U. avenae* in general, while *U. zeae* was somewhat similar at the lower temperatures but had its optimum at 30°. The characters of the promycelium were affected at the lower temperatures, at which all four species budded off sporidia or promycelial segments, which were sometimes 2-celled, from the apex of a short single basal cell (*U. longissima* type of germination). In fact, according to the temperature, it was possible to secure in all the species tested the four common types of promycelial formation known in the genus.

The influence of temperature on the reduction division and segregation of characters was tested on numerous isolations of the individual sporidia at different temperatures and was found to affect these. Characters such as the form and colour of the resulting colonies were found to be segregated independently of the sex characters.

Krause (A.). **Über Weizenbrand und Weizensorten**. [On Wheat smut and Wheat varieties.]—*Wiener Landw. Zeit.*, lxxxii, 33, pp. 258–259, 1932.

A brief, popular note on the occurrence and control of wheat bunt [*Tilletia caries* and *T. foetens*] and loose smut [*Ustilago tritici*] in Austria [*R.A.M.*, vi, p. 531] is followed by an account of a varietal experiment in connexion with the first-named disease. In 1928 the incidence of bunt on Kolben [Club] wheat was 10 per cent. while Loosdorf awned remained completely free from infection. In 1929 both varieties were treated with germisan, in spite of which Kolben again showed 25 per cent. bunt and Loosdorf practically none. In the following year the seed-grain was disinfected with uspulun at the maximum concentration, but nevertheless Kolben developed 50 per cent. or more bunt, Loosdorf again being immune. In the wet year 1929 Kolben gave a higher yield than Loosdorf, the latter being more prolific in the relatively dry seasons of 1928 and 1930. Other varieties from the south-east giving equally satisfactory results in another test were the Hungarian Kadolz and Banat, which showed next to no bunt in proximity to heavily infected (80 per cent.) Kolben.

Smith (R. W.). **Transferring smut immunity to hard red spring Wheat.**—*Journ. Amer. Soc. Agron.*, xxiv, 8, p. 662, 1932.

In 1927 Komar, a hard, red spring wheat, resistant to rust [*Puccinia graminis*], was crossed with Hussar, a hard, red winter wheat immune from certain physiologic strains of bunt (*Tilletia*

levis and *T. tritici*) [*T. foetens* and *T. caries*: *R.A.M.*, xi, p. 442]. The F_1 plants, unsmutted, were grown in the greenhouse at Arlington, Virginia, during the following winter, while the F_2 and succeeding generations were grown in the nursery at Dickinson, North Dakota, using smut-inoculated seed. About 4 per cent. of the plants developed bunt in the F_2, 5 per cent. in the F_3, none in the F_4, and only 1 in 3,241 in the F_5 generation. In the same tests Komar showed 24 to 42 per cent. of infection each year and Hope 1 to 3 per cent. Seed of 19 F_5 plants from bunt-free families was inoculated and grown in a greenhouse under favourable conditions for infection. No bunt was detected in the 19 hybrids, though every head of Komar was diseased. It would appear, therefore, that the immunity of Hussar from bunt has been transferred to a hard, red spring wheat by crossing, it is believed for the first time.

JARRETT (PHYLLIS H.). **Investigations of flag smut of Wheat.**—*Journ. Australia Council Sci. & Indus. Res.*, v, 3, pp. 165–169, 1 pl. [facing p. 189], 1932.

After a brief account of the biology and symptoms of flag smut (*Urocystis tritici*) of wheat [*R.A.M.*, x, p. 782], and of its geographical distribution, the author describes at some length greenhouse and field experiments in 1931 and 1932 to test the relative resistance to it of 40 (named) varieties of wheat, and also the effect of infection on their yield. Seed infection tests, in which the seed grain was presoaked for 8 to 12 hours, according to the variety, in a shallow dish of water on the surface of which smut spore balls had been soaked for about three days at 18° to 23° C., showed that none of the varieties or crosses so far tested was wholly and consistently immune from infection. Some of them, however, e.g., Bomen, Bunyip, Cedar, Galgalos, Geeralying, and Nabawa, showed a high degree of resistance. The yield tests will be reported later.

HENRY (A. W.). **Influence of soil temperature and soil sterilization on the reaction of Wheat seedlings to Ophiobolus graminis Sacc.**—*Canadian Journ. of Res.*, vii, 2, pp. 198–203, 1 pl., 2 graphs, 1932.

In the experiments briefly described in this paper Marquis wheat seedlings, grown in sterilized and unsterilized soil, were equally severely attacked at low temperatures (up to 20° C.) when inoculated with a virulent strain of *Ophiobolus graminis* [*R.A.M.*, xi, p. 708]. At higher temperatures, on the other hand, the intensity of attack by the fungus decreased in unsterilized soil (at 27° most of the seedlings were very slightly affected), while it remained practically unchanged in sterilized soils. These results would indicate, in the author's view, that the protective value to wheat of the soil saprophytes [ibid., x, pp. 448, 719; cf. also xi, p. 361] against soil-borne infection with *O. graminis* is relatively small at temperatures below 20°. Observations during the past 10 years show that take-all is much more destructive to spring wheat in western Canada than in the United States, possibly because of the lower soil temperature during at least part of the growing season in the

former region. Winter wheat is severely injured in both areas and is normally exposed to low temperatures in both.

MORITZ (O.). **Weitere Studien über die Ophiobolose des Weizens.** [Further studies on ophiobolosis of Wheat.]—*Arb. Biol. Reichsanst. für Land- und Forstwirtsch.*, xx, 1, pp. 27–48, 11 figs., 1932.

Continuing his studies on the occurrence of foot rot (blackleg) of wheat in Schleswig-Holstein [*R.A.M.*, x, p. 512], the writer again found the bulk of infection to be due to *Ophiobolus graminis*. The other well-known agents of the disease, *Leptosphaeria herpotrichoides* and *Wojnowicia graminis*, were absent and only in a few cases was *O. herpotrichus* detected by Dr. Pape.

Inoculation experiments with three strains of *O. graminis* resulted in more or less heavy infection on Carsten V winter wheat. Garnet summer wheat, Peragis, Reward, red Bordeaux, *Triticum monococcum* [var.] *hornemanni*, *T. persicum*, *T. turgidum* var., *T. compactum* var., Friedrichswerther Berg winter barley, Heine's Hanna summer barley, Mahndorfer Viktoria white oats, Petkus summer rye, *Vicia sativa*, Feddersen Rosenhof broad beans (*V. faba*), Victoria peas, and red clover (*Trifolium pratense*). The most virulent strain was one isolated by the writer in 1929. The symptoms produced by *O. herpotrichus* on Peragis wheat resembled those described by van de Laar in Holland [ibid., x, p. 446]. Comparative tests with *Fusarium culmorum* gave negative results. The experiments of Sanford and Broadfoot in Canada [cf. preceding abstract] showed the inhibitory effect of other soil-inhabiting micro-organisms on the development of *O. graminis*, and the importance of this factor was further demonstrated by the writer's inoculation tests with the virulent strain of the fungus on *T. persicum* in various sterilized and unsterilized soils. The highest percentage of infection (88) was obtained on sterilized marsh soil ploughed for the first time in 1926, and the lowest (18) on unsterilized black soil from the island of Fehmarn. The greatest risk of natural infection, however, occurs on the high heathland ('Geest'), in two unsterilized pots of which 68 and 75 per cent. of foot rot were obtained. It is concluded that while blackleg of wheat is primarily caused by fungal infection (from which the author found no variety to be immune), the liability to the disease depends in great measure on soil (including biological) factors. The possible applications of these data to a system of control based on manuring, soil treatment, and crop rotation are discussed.

LUNDEGÅRDH (H.). **Om gråfläcksjuka och liknande bristsjukdomar hos kulturväxter.** [On the grey speck and analogous deficiency diseases among cultivated crops.]—*Landtmannen Tidskr. for Landtmän*, xv, 38, pp. 775–777, 4 figs., 1 map, 1932.

A popular account is given of the grey speck disease of oats [cf. *R.A.M.*, xi, p. 295] in Sweden, where it has also been observed on barley, wheat, root crops, and flax. The most susceptible variety of oats in an official test was Dala, Mesdag being resistant and Seger intermediate. The disease is most prevalent in districts

where an excessively high lime content of the soil prevents the proper utilization by the plants of the potash and manganese necessary to their development; among such localities are north-west Skåne, Öland, certain parts of west and east Gothland, and Blekinge. An abundance of dry mould or of colloids, e.g., of iron, aluminium, or silicic acid, in the soil is also favourable to the disorder. The simplest and most direct means of combating grey speck is by the application of manganese sulphate in quantities not exceeding 50 kg. per hect., but in most cases this measure is likely to be prohibitively expensive. The requisite amounts of manganese may be released and rendered available to the plants by a dressing of ammonium sulphate [cf. ibid., vii, p. 470]. Applications of nitrates (e.g., saltpetre or calcium nitrate) are definitely injurious to crops on soils where grey speck is prevalent, and the nitrogen must be provided in the form of ammonia. Good yields may be obtained by the sulphate of ammonia treatment even where the natural supply of manganese is small (15 to 20 mg. per kg. soil). It is seldom that Swedish soils are so poor in this mineral as to necessitate direct applications of it. Great care should be taken to avoid an excess of lime in the soil, since this is the main factor preventing the assimilation of manganese. In places where the subsoil contains more manganese than the surface layers, deep ploughing is advisable.

Săvulescu (T.) & Rayss (T.). **Der Einfluss der äusseren Bedingungen auf die Entwicklung der Nigrospora oryzae (B. und Br.) Petch.** [The influence of external conditions on the development of *Nigrospora oryzae* (B. et Br.) Petch.]—*Phytopath. Zeitschr.*, v, 2, pp. 153–172, 4 figs., 2 graphs, 1932.

This is a considerably expanded account of the writers' studies on the influence of external conditions on the development in pure culture of *Nigrospora oryzae*, a parasite of maize in Rumania, a condensed version of which has already been noticed [*R.A.M.*, xi, p. 711].

Reichert (I.) & Hellinger (E[sther]). **Further experiments on the control of Diplodia stem-end rot of Citrus fruits by debuttoning.**—Reprinted from *Hadar*, iv, 10, 8 pp., 1931. [Received October, 1932.]

Continuing their investigations on the control of the stem-end rot of citrus due to *Diplodia natalensis* in Palestine [*R.A.M.*, xi, p. 508], the writers found that the losses from this disease are increasing. The amount of infection in fruit stored on the spot during 1930–1 was 4·9 per cent., and it was probably higher in exported lots. The fungus was completely removed by debuttoning, either after colouring with ethylene gas (1½ to 3 days at 21° to 22° C.) or after wilting for four days in the packing-house, both measures rendering the 'button' [fruit stalk and receptacle] easy to detach by slight pressure. In one experiment not a single fruit out of 505 that were debuttoned after wilting developed stem-end rot, against 39 out of 540 (7·2 per cent.) in the controls. The practical importance of this method of control is obvious, but the acceptability of debuttoned fruit in the market has yet to be tested.

Reichert (I.) & Hellinger (E[sther]). **Further experiments on the control of Diplodia stem-end rot of Citrus by pruning and spraying.**—Reprinted from *Hadar*, v, 6, 6 pp., 2 graphs, 1932.

Further experiments during 1930–1 were directed to testing the effect of pruning and spraying on the control of stem-end rot of citrus (*Diplodia*) [*natalensis*: see preceding abstract] in Palestine. They confirmed the results of previous tests [*R.A.M.*, ix, p. 777] in showing that the pruning of dead wood during June or July (preferably the former) considerably reduces the incidence of infection (by over 55 per cent.). The results obtained by spraying with 1 per cent. Bordeaux mixture in addition to pruning were conflicting.

Reichert (I.) & Hellinger (E[sther].). **Conditions affecting the appearance of Diplodia rot in Citrus fruits.**—*Hadar*, v, 9, pp. 203–206, 5 graphs, 1932.

An account is given of the writers' observations on the environmental conditions affecting the occurrence of stem-end rot of citrus (*Diplodia*) [*natalensis*: see preceding abstracts] in Palestine. Temperature and relative humidity were found to be important factors in the development of the fungus, which thrives in late February and March (temperature above 13° C. and relative humidity over 52 per cent.), while late December and January are nearly always unfavourable. The disease is most prevalent on heavy soils and chiefly affects the fruits on the lower parts of the tree, though the upper ones may also be involved to a considerable extent. Infection by *D. natalensis* was considerably increased by the presence of *Penicillium digitatum* and *P. italicum* on overripe fruit (picked in March). In inoculation experiments *P. digitatum* increased the amount of *Diplodia* rot from 6 in the non-inoculated controls to 10 per cent., *P. italicum* to 12 per cent., and both moulds combined to 15 per cent. [cf. ibid., viii, p. 237].

Report on the Agricultural Department, Dominica, April–December, 1931.—*Trinidad, Imper. Comm. of Agric. West Indies*, 16 pp., 1932.

During 1931, wither-tip and blossom blight of citrus (*Gloeosporium limetticolum*) [*R.A.M.*, xi, p. 284] appeared to be less prevalent in Dominica than in previous years, but the incidence of these diseases was masked by the heavy destruction of the lime trees through hurricanes and red root disease (*Sphaerostilbe repens*) [ibid., xi, p. 283]. Collar rot and kindred diseases of citrus [cf. ibid., viii, p. 500; ix, p. 628; x, p. 97] were confined mainly to seedling limes and seedling sweet oranges, though isolated attacks were also noted on budded trees where the budding had been near the bottom of the stem. Scab [*Sporotrichum citri*] was very prevalent in citrus nurseries where through its retardation of growth it caused heavy losses of stocks; sour orange [*Citrus aurantium* var. *bigaradia*] stocks were those chiefly affected.

The replanting of fields devasted by hurricanes with limes budded on stocks resistant to hurricanes and diseases is being effected rapidly and the earlier plantings have begun to fruit;

during the past four years approximately 58,000 budded limes have been distributed to growers.

Eighteen lime hybrids highly resistant to wither-tip and very closely resembling the West Indian lime have been crossed back to the West Indian, using the latter as male parent. One of the original hybrids (No. 29 Woglum hybrid) set a single fruit very similar in appearance to the West Indian lime. This hybrid, together with others, has now been reproduced by budding.

MAYNE (W. W.). **'Jeloo' and black bean in Coffee.**—*Planters' Chron.*, xxvii, 16, pp. 411–416, 1932.

The author states that the 1931–2 coffee crop in all the western districts of South India, from North Mysore to the Anamalais, was characterized by an extraordinary amount of decayed beans (locally known as black bean or 'jeloo' disease) [*R.A.M.*, iv, pp. 106, 591], causing financial losses which were estimated at a very high figure. In some cases the trouble developed even in coffee that had been thoroughly sprayed. The results of his own investigation in 1931, supported by those obtained by previous workers [loc. cit. and ibid., vi, p. 465] indicated that the condition is not primarily due to the activity of any parasitic organism, although in fallen berries secondary rots, including common saprophytic fungi, were present. In many cases, however, the fruit did not fall and showed no external sign of injury though the inner tissues were brown and soft. Healthy and rotted beans frequently occur in the same fruit. The fact that black bean occurs only in occasional years would appear to point to its being a result of unfavourable climatic conditions. and small-scale manurial experiments suggest that it may also be caused by nutritional disturbances in the plant.

STOUGHTON (R. H.). **The influence of environmental conditions on the development of the angular leaf-spot disease of Cotton. IV. The influence of atmospheric humidity on infection.**—*Ann. of Appl. Biol.*, xix, 3, pp. 370–377, 2 graphs, 1932.

The results of the experiments described in this paper [which were made with the same material and on the same lines as in the previous work: *R.A.M.*, xi, p. 297] showed that high atmospheric humidities, exceeding 85 per cent., favour the development of the angular leaf disease (*Bacterium malvacearum*) of cotton. At humidities below 85 per cent. the degree of infection decreased rapidly. From a discussion of the relation of these results to those of the experiments on the influence of air temperature [loc. cit.], the author concludes that the importance of humidity is mainly physical in nature, by affecting the time during which the droplets of moisture, allowing of the development of the bacteria, persist on the leaves of the host.

RAIFORD (T. S.). **Systemic blastomycosis with report of a case.**—*Bull. Johns Hopkins Hospital*, li, 2, pp. 61–82, 10 figs., 1932.

Full details are given of a fatal case of systemic human blasto-

mycosis with primary involvement of the skeletal system and an absence of the typical concomitant lesions generally associated with *Blastomyces* [*dermatitidis*: *R.A.M.*, xi, p. 643]. The pathological condition was markedly similar to those of tuberculosis and chronic osteomyelitis, with which systemic blastomycosis may readily be confused.

DAVIDSON (A. M.) & GREGORY (P. H.). **List of fungi infecting man in Manitoba.**—*Canadian Journ. of Res.*, vii, 2, pp. 233–235, 1932.

From this preliminary list of human ringworm fungi, including two species of *Microsporon* [*Sabouraudites* of Langeron & Milochevitch: *R.A.M.*, x, p. 243], three of *Trichophyton* [loc. cit.], and one of *Epidermophyton*, which were isolated since 1930 in two hospitals in Winnipeg, it would appear that the great majority of the clinical cases were due to members of the first-named genus, of which *M. audouini* [see next abstract] is by far the most common. *M. felineum* is provisionally taken as including *M. lanosum* [ibid., xi, p. 646].

DAVIDSON (A. M.) & GREGORY (P. H.). **A convenient source of Wood's light for the diagnosis of ringworm of the scalp.**—*Canadian Med. Assoc. Journ.*, xxvii, 2, pp. 176–177, 1 fig., 1 diag., 1932.

Since Margarot and Deveze discovered in 1925 that hairs infected with *Microsporon* or *Achorion*, when examined in the dark with ultra-violet light, fluoresce with a green light which is quite distinct from the fluorescent colour of the normal hair and skin, the quartz mercury-arc lamp fitted with Wood's glass, or some other filter capable of absorbing visible light but transmitting the longer ultra-violet rays, has been extensively used in the diagnosis of ringworm of the scalp [*R.A.M.*, x, p. 666]. A relatively inexpensive adaptation of this apparatus that can be plugged in on any ordinary circuit is the Mazda 'Photoflood' lamp with a life at 115 volts of about two hours. Two thicknesses of $\frac{3}{16}$ in. Corning Heat Resistant Red Purple Ultra glass No. 587 are used as a filter, on the outside of which is placed a plano-convex condensing lens in order to produce a concentrated beam of faint violet light. The latter is turned in a darkened room on the areas of the scalp where ringworm or favus is suspected. Patches or even single hairs infected with *M. audouini*, *M. lanosum* [see preceding abstract], and *Achorion schoenleini* emit a bluish-green light in strong contrast to the dark colour of normal hairs. The green fluorescence has not been observed by the writers in cases of infection by *Trichophyton* spp.

GRIGORAKIS (L.). **De l'action de l'éther sur les microvégétaux parasites du tissu animal (facteurs de virulence, vitalité, dégradation et mutation).** [On the action of ether on microscopic plants parasitic on animal tissue (factors of virulence, vitality, degeneration, and mutation).]—*Comptes rendus Acad. des Sciences*, cxcv, 13, pp. 555–556, 1932.

Cultures of *Rhinocladium* [*Sporotrichum*] *beurmanni* [*R.A.M.*,

xi, p. 646] exposed to the fumes of sulphuric ether for two minutes developed much more rapidly than similar cultures not so treated. Subcultures of these were similarly exposed for five minutes, and after this procedure had been repeated some ten times the colonies lost their pigment and assumed a glistening white appearance, very few conidia were formed, and virulence for laboratory animals was lost. It would appear from these experiments that mutation may accompany vegetative deterioration in the absence of the normal reproductive cycle.

GRIMES (M.), O'CONNOR (M.), & CUMMINS (H. A.). **A study of some Phoma species.**—*Trans. Brit. Mycol. Soc.*, xvii, 1–2, pp. 97–111, 2 pl., 1932.

After a brief discussion of the taxonomy of the genus *Phoma* and its relationship to *Phyllosticta*, a description is given of two species, one of which was isolated from samples of milk, cream, butter, and water, and the other from butter alone, submitted for examination to the bacteriological department of University College, Cork. On most solid media the first produced compact, circular, flat, submerged colonies with abundant pycnidia embedded in the upper surface. The latter are globular, flask-shaped or lenticular, and measure 60 to 108 by 50 to 200 μ. The pycnospores are hyaline, continuous, oblong, rounded at both ends, and 5 to 7 by 4 μ; a few are rounded and 3 μ in diameter. The fact that it proved non-pathogenic on various plants tested, and that it did not agree in its cultural characters [details of which are given] with any other known member of the genus, leads the authors to consider it as new to science, and to name it *Phoma hibernica* n. sp. The cultural characters, pathogenicity to tomato and ivy, and morphology of the species isolated from butter alone indicate that it is identical with *P. destructiva* [*R.A.M.*, x, p. 414], the cross-inoculation experiments and characters of the ivy parasite usually known as *Phyllosticta hedericola* [ibid., x, p. 462] indicating that the two species are identical.

The paper includes a tentative scheme [in the form of a key] for the classification of some of the species of *Phoma* encountered by the authors, based on cultural and physiological properties.

GRIMSHAW (A. H.). **Mildewed wool. Comparison of some oil compounds for probable nutrient properties.**—*Melliand Textile Monthly*, iv, 4, pp. 253–256 ; 5, pp. 300–303, 9 figs., 1932.

A brief survey of some papers on mildew in textile fabrics precedes the writer's account of his investigations on this problem in American mills. Trade experience indicates that moulds are more important than bacteria as a source of injury to textiles.

The writer obtained cultures from mildewed wool in New Jersey and North Carolina in Petri dishes of various media inoculated with fragments of the wool. On agar media without oil, kept in a dark, warm place at 96° F., no mould development occurred after 264 hours. In gelatine media without oil, in a dark, cool place, mould formation (? *Aspergillus niger*) [cf. *R.A.M.*, x, p. 598] took place in 96 hours. After three weeks slight growth appeared on mildewed yarn placed in agar media plus a small amount of mineral

oil, but none where gelatine was substituted for agar. Rapid mildew development took place in gelatine or agar with olive oil emulsion at laboratory temperature. In another series of tests various wool oil compounds (1 to 3 per cent.) were added to a medium consisting of agar and tragacanth and inoculated as above, some of the dishes being covered but exposed to the light, others uncovered, while a third series was kept in containers which excluded light. Mildew occurred after two days in the nutrient medium plus a lard oil base, both in the light and dark, while traces were observed in three or four days with a strong soap base; with olive oil incipient growth took place after two days in the light and after three in the dark. After three weeks there was only a trace of mildew in the nutrient medium with a strong mineral oil base, while no growth occurred where corrosive sublimate and ammonium chloride (each at a strength of 1 in 50,000) or a mineral oil emulsion used for spraying cotton were added. In the uncovered dishes the medium dried up and no mould development took place, showing that moisture is essential for growth.

Parsons (B.) & Massey (L. M.). **Rose-disease investigations. Third progress report.**—*Amer. Rose Ann., 1932*, pp. 47–58, 1932.

In the third season of field tests in Pennsylvania to determine the relative efficacy of various fungicides against black spot and brown canker of roses (*Diplocarpon rosae* and *Diaporthe umbrina*) [*R.A.M.*, x, p. 793], sulphur dusts, especially pomogreen and kolotex (both 90–10 sulphur-lead arsenate but the former dyed green), once more proved superior to the liquid treatments except Bordeaux mixture which gave better results in controlling black spot than in the two preceding years. Manganar dust (chiefly sulphur and manganese arsenate) [ibid., x, pp. 58, 389] also proved highly effective. It is thought that the relative inferiority of the sprays may be due to their failure to adhere to the waxy cuticle of the leaf. Fungicides containing sulphur were more effective against brown canker than those containing copper. The Margaret McGredy, Mari Dot, and Charles P. Kilham varieties were used in the black spot trials, and Mrs. Henry Morse and Charles P. Kilham in the brown canker tests.

Ogilvie (L.). **Brown canker of Roses in England.**—*Trans. Brit. Mycol. Soc.*, xvii, 1–2, p. 153, 1932.

The author records what he believes to be the first discovery in England of *Diaporthe umbrina* [*R.A.M.*, x, p. 666 and preceding abstract] causing a severe wilt and die-back of rose plants in Gloucestershire in 1931. The fungus, which was identified by Miss Jenkins, caused characteristic cankers on inoculated rose shoots.

Fischer (R.). **Die wichtigsten Pilzkrankheiten der Dahlien.** [The most important fungous diseases of Dahlias.]—*Gartenzeit. Oesterr. Gartenbaugesellsch. in Wien, 1932*, pp. 6–8, 1 fig., 1932. [Abs. in *Bot. Centralbl.*, N.F., xxi, 15, p. 476, 1932.]

Notes are given on the following diseases of dahlias in Austria: (*a*) on the aerial organs: grey mould (*Botrytis cinerea*), smut

(*Entyloma dahliae*) [see next abstract], and true mildew [? *Erysiphe cichoracearum*: *R.A.M.*, iv, p. 466]; and (*b*) on the underground system: crown gall (*Pseudomonas* [*Bacterium*] *tumefaciens*), dry rot of the bulbs (*Fusarium* spp. and *Verticillium dahliae*) [ibid., xi, p. 792], and wet rot (*B. cinerea*, *Sclerotinia sclerotiorum*, and other organisms). Control measures are indicated.

GREEN (D. E.). **Smut disease of Dahlias caused by Entyloma dahliae (Sydow).**—*Journ. Roy. Hort. Soc.*, lvii, 2. pp. 332–339, 6 pl. (2 facing pp. 328–329), 1 fig., 1932.

A widespread spotting of dahlias at Wisley, Surrey, affecting some 274 varieties to a greater or lesser extent in 1931, was found to be due to *Entyloma dahliae* [*R.A.M.*, ix p. 409]. The first symptoms are small, pale circular spots on the lower leaves, rapidly expanding to a diameter of $\frac{1}{16}$ to $\frac{1}{4}$ in. (sometimes up to $\frac{3}{4}$ in.), and turning brown in the centre, which may fall out. When large numbers of spots occur they may coalesce to form extensive areas of diseased tissue, and ultimately most of the leaf-blade may shrivel and die. Defoliation rapidly ensues on badly affected plants, and even in mild cases the vigour of the host is greatly impaired. The Mignon varieties suffered most from the attacks of *E. dahliae*, closely followed by the small-flowered Paeony types.

Good control of the disease was given by two applications of 4–4–50 Bordeaux mixture (8th and 11th August), applied by a Four Oaks barrel sprayer (Battle pattern), using a lance with a double Vermorel nozzle and adding saponin ($\frac{1}{2}$ oz. to 24 galls.) as an adhesive [ibid., xi, p. 375].

WORMALD (H.). **A bacterial disease of Lilacs.**—*Gard. Chron.*, xcii, 2381, pp. 116–117, 4 figs. (2 on pp. 114–115), 1932.

Lilac shoots submitted to the writer for examination from Marlborough, Wiltshire, were found to be infected by a bacterial blight similar to that due to *Pseudomonas syringae* [*R.A.M.*, x, p. 96], inoculations with the rod-shaped bacterial organism isolated from which, on wounded shoots, produced the typical symptoms [which are briefly described] of the disease as it occurs in the United States and on the Continent. Full cultural tests of the organism to confirm its identity have not yet been carried out.

TILFORD (P. E.). **Calla Lily root rot and its control.**—*Bi-monthly Bull. Ohio Agric. Exper. Stat.* 157, pp. 138–140, 1 fig., 1932.

Considerable damage has been caused of recent years in Ohio by the root rot of Calla lilies [*Zantedeschia aethiopica*] due to *Phytophthora richardiae* [*R.A.M.*, ix, p. 787]. Affected plants show a yellowing and wilting of the foliage, discoloration and malformation of the blossoms, and rotting of the feeder roots, sometimes extending into the corms. The roots present a water-soaked appearance, and finally all that remains of them is the hollow tube of the epidermis; the texture of the rotted corms remains fairly dry and spongy. The fungus lives over from one crop to the next partly on the corms. Good control of the disease has been obtained by one hour's immersion of the corms before

planting either in 2 per cent. formaldehyde or mercuric chloride (1 oz. to 7½ galls.), semesan being less effective.

Bongini V[irginia]. **Sur una malattia delle Cactacee.** [On a disease of Cactaceae.]—*La Difesa delle Piante*, ix, 3, pp. 34–39, 2 figs., 1932.

Cactus plants (*Cereus senilis*, *C. grusonianus*, and other species of *Cereus*) growing in glasshouses in Turin from seed sent from Mexico wilted when five or six months old and then died within three or four days. The affected stems showed the presence of a species of *Helminthosporium* with simple or bifurcated, nodulose, fuliginous, denticulate conidiophores which measured 90 to 170 by 7 to 13 μ and were paler at the top than at the base. The acrogenous conidia were usually single, but sometimes borne in twos or threes, and were smooth, pale (later dark) brown, obclavate-fusoid or cylindrical, rounded at the ends or obpyriform, sometimes narrowed at the base, and with two to six, usually four, cells: they measured 30 to 65 by 10 to 13 μ. The fungus is named *H. cactacearum* Bongini n. sp., and a Latin diagnosis is given. Inoculations of very young cactus plants gave positive results. The organism is probably a weak parasite attacking plants in a receptive condition with, perhaps, minute lesions in the epidermis.

Preventive measures should consist in sterilizing the soil by heat before setting the seed and spraying during the first year of growth with copper oxychloride.

Servazzi (O.). **Nota preliminare su una Phoma sp. n. riscontrata su Echeveria multicaulis purpurea.** [A preliminary note on a new species of *Phoma* found on *Echeveria multicaulis purpurea*.]—*La Difesa delle Piante*, ix, 3, pp. 39–42, 1 fig., 1932.

From the stem cortex of an *Echeveria multicaulis purpurea* plant which wilted, became defoliated, and died, the author isolated a species of *Phoma* with septate, branched hyphae 2·5 to 3·5 μ in diameter; simple, globose-ovoid or pyriform pycnidia averaging 350 μ broad; and cylindrical spores, measuring 8·3 to 8·5 by 3·5 to 3·4 μ and borne on very short, hyaline stalks. Elliptical pycnospores, measuring 6·6 by 3·2 to 3·3 μ, were occasionally noted. Sclerotium-like aggregations were found in some of the diseased tissues, especially at the apex of the stem, where the disorganization was least advanced. Although isolated from dead material the fungus is considered to be most probably parasitic. Further investigations are in progress.

Communications diverses sur le traitement hivernal des arbres fruitiers. [Various communications on the winter treatment of fruit trees.]—*Rev. Path. Vég. et Ent. Agric.*, xix, 3, pp. 70–118, 1 pl., 1932.

This is a collection of papers which were read at the March 1932 meeting of the Société de Pathologie Végétale et d'Entomologie Agricole de France, dealing with the winter treatment of fruit trees in various European countries, chiefly against insect pests,

but incidentally against fungal diseases. The individual papers are by C. T. Gimingham (England); L. Petri (Italy); N. Van Poeteren (Holland); H. Faes (Switzerland); P. H. Joëssel and F. Willaume (France). Most of the information of mycological interest contained in these papers has already been noticed in this *Review*.

The orchard spray programme. Control of pests attacking Apples.—*Tasmanian Journ. of Agric.*, N.S., iii, 3, pp. 110–119, 5 figs., 1932.

This is a detailed account of the results in 1932 of a comparative test of five different spray programmes carried out on a block of 15-year-old Sturmer Pippin apples. The materials tested, each in five applications involving a total of about 7 galls. liquid per tree, were weak dry lime-sulphur throughout, liquid lime-sulphur throughout, strong dry lime-sulphur throughout, iron sulphide excess lime-sulphur, and Bordeaux mixture followed by lime-sulphur and atomic sulphur. Arsenate of lead was added to the post-blossom sprays in every case. While all the schedules gave good commercial control of black spot [scab: *Venturia inaequalis*], the largest percentage of clean (93·5) and of marketable (98·7) fruit was given by the last-named programme, the cost of which is estimated at 9½*d.* per tree. It consisted of 6–4–40 Bordeaux mixture in the green tip stage, 1 in 20 liquid lime-sulphur in the pink stage, 1 in 40 ditto calyx spray, and 5 lb. atomic sulphur paste in 40 galls. water in the 4th and 5th sprays. Though apple mildew [*Podosphaera ? oxyacanthae*] was almost absent, experience has shown that this programme gives effective control of the disease [cf. *R.A.M.*, iii, p. 722; v, p. 675]. The best quality and most attractive fruit was obtained in the strong dry lime-sulphur series, but its high cost (11½*d.* per tree) and its lesser efficacy against scab (10·2 per cent. spotted fruit) militate against its general use. The cheapest schedule (7½*d.* per tree) was the complete liquid lime-sulphur one, but the higher percentage (12·3) of spotted fruit it produced renders its economic value questionable: the same also applies to the iron sulphide excess lime-sulphur spray, which cost 8½*d* per tree but gave 11·3 per cent. spotted fruit. The least effective against scab was the weak dry lime-sulphur schedule, which gave 15.1 per cent. spotted fruit, and cost 8*d.* per tree.

Although in several cases the spray mixtures were used at strengths often considered dangerous, very little leaf scorch or russeting was experienced, possibly owing to the addition of effective spreaders [*R.A.M.*, xi, p. 587].

Dutton (W. C.). **Spray injury studies. I. Injuries from summer applications on Apples. II. Secondary effects of spray injury to Apple foliage.**—*Michigan Agric. Exper. Stat. Special Bulls.* 218, 68 pp., 2 col. pl., 19 figs. (1 col.); 219, 38 pp., 1 fig., 16 graphs, 1932.

Continuing his investigations on various aspects of apple scab [*Venturia inaequalis*] control in Michigan [*R.A.M.*, ix. p. 656].

the writer gives a fully tabulated account of recent observations on the injury caused by different methods of treatment.

Lime-sulphur, alone or in combination with lead arsenate, was found to cause definite and almost immediate damage characterized by the more or less extensive development of scorched leaf tissue. This form of injury is favoured by high temperature, though it may also occur under cooler conditions. Spray injury is further promoted by high humidity and slow drying at high or low temperatures, whereas low humidity and rapid drying are unfavourable to burning even at high temperatures. Generally speaking, high concentrations of lime-sulphur (e.g., $2\frac{1}{2}$ galls. in 100 galls. water) cause more injury than lower ones, while other factors tending to increase the damage are heavy applications and the presence of oil in the mixture.

Foliar distortion often arises from marginal injury by lime-sulphur on partly grown leaves. The stunting and blistering due to frost of the leaves appearing with the blossom buds may be increased by lime-sulphur, the excessive use of which with lead arsenate is further apt to retard development. Lime-sulphur injury frequently occurs through scab lesions on the leaves, killing the fungus but at the same time causing defoliation. Any form of sulphur on the foliage appears to increase sun scald.

Slightly less injury generally follows the use of dry lime-sulphur at concentrations equivalent to the liquid (4 lb. for 1 gall.) on Jonathans, while McIntosh is susceptible to russeting from this source. Free sulphur sprays, e.g., dry-mix, wettable sulphur, and flotation sulphur [ibid., xi, p. 788 and next abstract], and calcium monosulphide (cal-mo-sul) [ibid., viii, p. 387 *et passim*] appear to cause no damage to apple foliage.

Yellow leaf, a frequent sequel to treatment with lime-sulphur and acid lead arsenate, especially on the Wagener variety, is attributed to the formation of water-soluble arsenic on the combination of these materials. In the early stages this disturbance may be characterized by purple or reddish spots, but as a rule brown lesions of varying size develop, followed by yellowing of the leaves and soon afterwards by defoliation. This type of injury may be observed within a week or ten days after treatment or it may not occur until later. Much of the russeting of the fruit accompanying the use of lime-sulphur and lead arsenate probably arises from injury by water-soluble arsenic. Blossom-end injury is due to the soluble arsenic in the lead arsenate used with lime-sulphur and in other combinations.

Injury to apple leaves in the form of purple, later brown, spots, sometimes followed by yellowing and dropping, may be caused by Bordeaux mixture, while the russeting of the fruit consequent on early summer applications of this preparation is a limiting factor in its use in Michigan. Severe damage to both fruit and foliage has been caused by other copper sprays, such as basic copper sulphate and copper carbonate.

Discussing the secondary effects of spray injury to apple foliage, the writer finds that an excessive loss of fruit in the 'June drop' may result from unduly heavy or frequent treatments, high concentrations, heavy spraying from under the trees, and severe

lime-sulphur burn in the petal-fall or two weeks' applications. The production of blossom buds and consequently of fruit may be adversely affected by serious injury to the leaves, while the setting of the fruit may also be reduced by fungicidal treatments. The premature dropping of fruit just before harvest is often more extensive following considerable injury to the leaves, which may also reduce the size of the apples and prevent the full development of the red colouring. The measurement of annual rings also indicates an arrest in wood growth where the leaf area is diminished by spray injury.

Burkholder (C. L.). **Dusting vs. spraying in Apples 1927–1931.**—*Indiana Agric. Exper. Stat. Bull.* 356, 28 pp., 1931. [Received November, 1932.]

The results [which are fully tabulated and discussed] of five seasons' experiments in Indiana on the relative merits of some standard fungicides and dusts in apple scab [*Venturia inaequalis*] control on the Jonathan, Stayman, Grimes, and Rome varieties showed that the dry treatments were less reliable throughout. When the rainfall was heavy in April and May (1929), even 14 applications of colloidal sulphur-arsenate (85–15) dust failed to suppress infection on Rome and Stayman, though it was effective for this purpose in dry seasons, e.g., 1931. Greatly improved scab control was secured by the application of either liquid or dry treatments during blossoming when this process was prolonged. The general appearance and vigour of the foliage was best on the dusted and flotation sulphur liquid plots [see above, p. 12, and preceding abstract]. In 1930 and 1931 dry lime sulphur-sulphur dust and flotation sulphur dust were equally effective with the colloidal preparation, while flotation sulphur paste and wettable powder gave as good scab control as the lime-sulphur spray. In 1931 severe yellowing and defoliation occurred on a plot treated with lime-sulphur and lead arsenate (4 lb. of each to 200 galls. water), the temperature at spraying time (14th July) being 85° F. Considerable foliage burn was observed in the plots dusted with flotation sulphur in July and August. Taking the results on Rome and Stayman as a whole, the injury on the dusted plots amounted to 13·8 per cent., compared with 4·9 per cent. on the sprayed ones. In conclusion the results of recent investigations on similar lines in other States are briefly summarized.

Loewel (E. L.). **Das Auftreten des Fusicladiums im Altländer Obstbaugebiet in seiner Abhängigkeit von Klima, Standort, Obstarten und-sorten und seine praktische Bekämpfung auf Grund zweijähriger Versuche des Obstbauversuchsringes.** [The occurrence of *Fusicladium* in the Alteland orchard region as conditioned by climate, habitat, fruit species and varieties, and its practical control on the basis of two years' experiments by the fruit-growing experimental circle.]—*Angew. Bot.*, xiv, 3, pp. 233–277; 4, pp. 283–333, 26 figs., 2 graphs, 1932.

A very detailed account, supplemented by numerous tables, is given of two years' experiments in the Alteland district of Hamburg in

the control of apple scab (*Fusicladium*) [*Venturia inaequalis*: *R.A.M.*, x, p. 672], the incidence of which in relation to climate, soil, and other local factors is fully discussed.

The best pre-blossom spray was found to be 2 per cent. Bordeaux mixture [see next abstract], which should be applied about the 20th to 25th April. With the aid of a special brand of tree-spraying carbolineum (Baumspritzmittel Avenarius) [*R.A.M.*, vi, p. 364], it is possible to combine the carbolineum treatment (indispensable under Alteland conditions) with the first pre-blossom anti-scab application in one working shift. The first post-blossom spray should be given immediately after the fall of the petals and withdrawal of the bees. The choice of fungicides must depend on the variety; the arsenic-containing copper fungicide nosprasit (1930) 0·5 to 0·75 per cent. or Sch. 987 (a more highly concentrated brand of the arsenic-free nosperit) at a strength of 0·3 to 0·5 per cent. are generally suitable and give excellent results. Bordeaux mixture at a concentration of 0·5 per cent. was superior to 0·25 per cent. but not very markedly so. Both concentrations were better than 2 per cent. lime-sulphur or 1 per cent. solbar. For varieties susceptible to scorching from copper preparations [a list of which is given], the 0·25 per cent. Bordeaux mixture is fairly safe and is more effective than lime-sulphur or solbar when scab is severe. The second post-blossom application, when the fruits are the size of a hazel-nut, should consist of 0·25 to 0·3 per cent. nosprasit. Owing to the great risk of late infections in the district under observation, fungicidal treatments in the middle of July and middle of August are essential. Apples intended for storage may be sprayed with copper-containing mixtures at fairly high concentrations, e.g., 0·5 per cent. Sch. 987 or Bordeaux mixture, while those for early picking should be treated with 2 per cent. lime-sulphur plus 1 per cent. lead arsenate paste.

The economic aspects of the treatment are considered and it is estimated that, under normal Alteland conditions, a net gain of M. 1321·30 per hect. (200 25-year-old trees) should accrue in comparison with a similar unsprayed area. Even 10 per cent. of this increase would be of immense value to the working fruit grower.

Braun (K.). **Tätigkeitsbericht der Biologischen Reichsanstalt für Land- und Forstwirtschaft, Zweigstelle Stade, für die Zeit vom 1. April 1931 bis 31. März 1932.** [Report on the work of the Stade branch of the National Biological Institute for Agriculture and Forestry for the period from 1st April, 1931 to 31st March, 1932.]—Reprinted from *Altländer Zeit.*, Jork, 103, 111, 114, 116, 119, 123–4, 127, 9 pp., 1932.

The following items of phytopathological interest occur in this report. The best control of apple scab (*Fusicladium*) [*Venturia inaequalis*] in the Hamburg district of Germany during the period under review was given by Bordeaux mixture, although the standard concentration of 0·25 per cent. proved scarcely strong enough for the wet summer of 1931. Lime-sulphur (1 per cent.), cupulvit dust [ibid., xi, p. 767] (officially recommended by the German Plant Protection Service), Teller's copper-lime dust,

hercynia neutral (a copper-arsenic spray manufactured by Gebr. Borchers A.-G., Goslar-am-Harz), cutarsol, and nosprasit 'O' were less effective. The value of an application at the end of August was very noticeable in the case of Schur apples affected by late and storage scab [ibid., x, p. 800 and preceding abstract].

TURNER (H. A.). **Spore discharge of black spot (Venturia inaequalis).**—*Tasmanian Journ. of Agric.*, N.S., iii, 3, p. 128, 1932.

Investigations in 1931 of the seasonal discharge of the ascospores of the apple black spot [scab] fungus (*Venturia inaequalis*), which were made on the same lines as in the preceding year [*R.A.M.*, xi, p. 112], showed that there was a normal leaf fall of the trees in the preceding autumn, followed by an unusually wet winter and a spring rainfall below normal, and that only three ascospore discharges occurred during the whole season. This was in striking contrast to the 1930 season (which was marked by an early leaf fall, a wet winter, and a comparatively dry spring), during which the ascospores were discharged on sixteen separate occasions [loc. cit.].

HORNE (A. S.). **Biological work on fruit.**—*Dept. Sci. & Indus. Res., Rept. Food Invest. Board for the year 1931*, pp. 272–289, 4 pl., 3 graphs, 1932.

Periodical exposures of plates in apple orchards were made from May, 1930, to May, 1931, in collaboration with Mr. Nitimargi [*R.A.M.*, xi, p. 51], in order further to investigate the distribution of fungi and bacteria in the air surrounding the trees. The [tabulated] results demonstrated that the principles governing the distribution of fungi or bacteria, considered as a class, also govern the distribution of individual species or groups of strains and are the same as those governing, say, the accuracy of dilution technique in estimating the numbers of organisms. Over 30 genera were recognized (in collaboration with Miss Carter) on the slides, those occurring most frequently being *Fusicladium*, *Cladosporium*, *Pleospora*, *Epicoccum*, *Alternaria*, *Sporotrichum*, *Botrytis*, *Fusarium*, and *Polyopeus*. The great majority of the fungi were found experimentally to be capable of invading the tissues of apples having, like Worcester Pearmain, a low acid content. Definite sources of infection found included *Cladosporium* on decaying apple leaves and diseased stalks of *Lolium italicum*, *E. granulatum* on the sclerotia and conidia of *Claviceps* (commonly parasitic on *L. italicum*), and *Trichothecium roseum* on decaying apple leaves.

Studies (with L. N. Seth) were continued of resistance in relation to the chemical composition of apples with special reference to the interaction between fungal growth and varied acid and sugar content, in which 14 different strains of *Diaporthe*, *Cytosporina*, and *Phomopsis* were tested. When the maximum growth rate in culture was obtained at zero acid or sugar, the resistance of the apple increased with increasing acid or sugar (e.g., some strains of *C. ludibunda*), but if the maximum growth rate is at some concentration other than zero resistance will first fall and then rise (some strains of *F. fructigenum*). Studies in collaboration with

L. N. Seth and S. N. Das Gupta showed that the order of attacking power of different strains and species of fungi may be expected to vary with the variety of apple if the varieties differ in acidity, and also with the age of the apples, as acidity diminishes with the age of the fruit. This was confirmed by experimental inoculations. In Bramley's Seedling, for example, in which acidity is relatively high, *C. ludibunda* (strain CE) was more active than *D. perniciosa* (strain DHF), but in Worcester Pearmain apples, in which acidity is relatively low, this order was reversed.

Other studies with L. N. Seth of induced changes in resistance confirmed the conclusion previously reached that apples injected with malic acid showed more resistance to fungal attack than uninjected apples, and also demonstrated that resistance was similarly increased when the apples were injected with sucrose. Three preliminary tests with potassium salts (chloride and malate) were made with Worcester Pearmain, using *D. perniciosa* (strain DHF), and in each test the radial advance recorded for the injected apples was less than that recorded for the uninjected ones.

To test whether ringing apple trees by lowering the nitrogen content increases resistance to attack, an experiment was carried out in which 20 apples each from ringed and unringed Newton Wonder trees were inoculated on one side with *C. ludibunda* and on the other with *D. perniciosa*, and stored at 18° to 20° C. for eight days. The apples from the ringed trees were found to have a lower nitrogen content than the others and a much lower total weight of decayed tissue, indicating a higher level of resistance.

In work on the effect of the stocks on the resistance of apples to storage rots Worcester Pearmain inoculated with *F. fructigenum* and Bramley's Seedling with *C. ludibunda* were tested, the stocks used being East Malling IV, V, VI, and X [ibid., iv, p. 354]. An analysis of the figures obtained for the mean radial advance of fungal attack per day showed that the stock does exert a definite influence on the resistance of the fruit of the scion.

Tests were also made of the effect on resistance of manuring with sulphate of ammonia, muriate of potash, and superphosphate, alone or in various combinations. The apples were all inoculated with *C. ludibunda* and stored at laboratory temperature. It was found that they fell into two groups, characterized, respectively, by high and low nitrogen content, the former group including only those from the sulphate of ammonia plots. All the sets with low nitrogen content were much more resistant than those with high, the most resistant of all coming from plots with muriate of potash; in these apples the amount of rotted tissue was almost negligible. In the high nitrogen group, the apples from the plot to which all three constituents were applied were much more resistant than where sulphate of ammonia was used singly or in combination with superphosphate.

KIDD (F.). **Influence of fungal invasion and mechanical injury upon the rate of carbon-dioxide production of Apples.**—*Dept. Sci. & Indus. Res., Rept. Food Invest. Board for the year 1931*, pp. 111–114, 5 graphs, 1932.

Experiments [which are described and the results of which are

expressed graphically] were carried out in connexion with a biochemical study of senescence in stored apples to ascertain what effect an invading fungus causing an enlarging rot has upon the carbon dioxide production of sound tissue in the same fruit. They showed that when the carbon dioxide production of sound whole apples was compared with that of similar ones inoculated with *Penicillium* sp. and with that of apples killed by freezing at −20° C. and then inoculated with the same fungus, there was, during the progress of rotting, an excess of carbon dioxide production which was not accounted for either by the mass of the rotted tissue or that of the sound tissue. It is attributed to increased production in the contact-zone between the spreading rot and the sound tissue. Whether the excess carbon dioxide production of this contact-surface arises from the tissue cells of the apple *in articulo mortis* or from the growing tips of the advancing fungal hyphae remains to be determined.

Tomkins (R. G.) & Trout (S. A.). **The prevention of decay of stored fruit by the use of volatile compounds.**—*Dept. Sci. & Indus. Res., Rept. Food Invest. Board for the year 1931*, pp. 117–119, 1932.

After pointing out that any substance introduced for the purpose of preventing fungal rot into an atmosphere in which fruit is kept in storage must, if absorbed by the fruit, be non-injurious to health or else it must be removed by the metabolic processes taking place, the author states that acetaldehyde and ammonia satisfy these conditions and can, on a laboratory scale, prevent certain types of fungal rotting in certain fruits. Oranges and soft fruits stored in small concentrations of acetaldehyde remained more free from fungal attack than did similar samples stored in air.

The partial pressure of acetaldehyde required to prevent fungal attack is approximately that maintained by an aqueous solution of 1 in 200 to 500 parts by volume: the vapour concentration above such a solution held at 18° C. is about four-fifths the concentration of the solution. When sample lots of 20 wounded, inoculated oranges were stored in air and in acetaldehyde solutions of various concentrations, all those kept in air had rotted after only 7 days, whereas even after 30 days only 4 of these kept in 1 in 200 acetaldehyde had developed any rot.

Green mould of citrus (*Penicillium digitatum*) may be largely reduced by storing the fruit in air containing small quantities of ammonia [*R.A.M.*, xi, p. 366], the partial pressure of ammonia required being equal to that maintained by a solution of 25 c.c. of concentrated ammonia in 10 l. water; such a solution maintains a vapour concentration in air of 5 parts per 10,000 at 18°, 3 parts at 10°, and 2·5 parts at 3°. At higher concentrations the fruit is damaged.

When sample lots of 13 wounded oranges inoculated with *P. digitatum* were stored in air and in air containing various proportions of ammonia, the lot kept in air showed 11 rotted fruits after 7 days, whereas the lot stored in air containing 5 parts per 10,000 of ammonia showed only 6 rotted fruits after 28 days.

By dissociation ammonium bicarbonate crystals maintain a suffi-

cient ammonia pressure to prevent fungal growth. If oranges inoculated with *P. digitatum* are placed with or without wrappers in desiccators containing the crystals, rotting is largely prevented without injury to the fruit.

HOCKEY (J. F.) & WARD (R. W.). **Studies in Apple storage. I. The influence of fungicides on flavour and sugar content.**—*Scient. Agric.*, xii, 12, pp. 709–715, 1932.

The investigation briefly reported in this paper was made in continuation of the study initiated by De Long and Pickett of the effect of fungicidal sprays on the composition of apple fruit [*R.A.M.*, x, p. 674], and was carried out on apples of the 1930 crop from variously treated trees of the McIntosh, Ribston, Stark, and Northern Spy varieties in Nova Scotia. The results indicated that Bordeaux mixture sprays, under the climatic conditions of the season, tended to increase the sucrose and total sugar of the apples in all the varieties tested, while aluminium sulphate-lime sulphur sprays had the same effect in only two of the four varieties tested. Spraying with lime-sulphur alone tended to depress the sugar content in two of the varieties. Palatability tests showed that the flavour of the fruit is improved by a higher sugar content.

TILLER (L. W.). **Influence of carbon dioxide on internal breakdown in the Sturmer.**—*New Zealand Journ. of Sci. & Techn.*, xiv, 1, pp. 20–22, 1 fig., 1932.

Tests were initiated in the summer of 1931, with funds placed at the disposal of the Cawthron Institute by the Department of Scientific and Industrial Research, to determine the influence of carbon dioxide in the storage atmosphere on the incidence of internal breakdown in Sturmer apples [cf. *R.A.M.*, iv, p. 549; ix, p. 462]. The experiments were carried out at a temperature of 35° F. on fruit that had already been in storage at 38° for 11½ weeks.

The concentrations of carbon dioxide tested were 0·4, 5, and 10 per cent., while the oxygen content ranged from 18 to 20 per cent. For the lowest concentration pure air was used, freed from carbon dioxide by passage through an aspirator containing pumice saturated with caustic potash solution. The other cylinders contained slightly less than the desired concentrations of carbon dioxide, the rate of flow of gas being so adjusted by means of a reducing-valve that the apples evolved sufficient carbon dioxide to bring the total percentage to the requisite figure. Before introduction into the containers all the gases were brought to the same relative humidity. The fruit was held under these conditions from 3rd July till 21st December and examined four days later.

The presence of carbon dioxide was found to have caused a definite increase in the amount of internal breakdown, 7 per cent. of the fruit at the 10 per cent. concentration showing severe symptoms and 44 per cent. slight, the corresponding figures at 5 per cent. being 3 and 24, and at 0·4 per cent. 0 and 8, respectively. It is evident, therefore, that carbon dioxide concentrations even well below the danger limit for the development of brown heart [ibid.,

iv, p. 224; ix, p. 115; x, p. 115] are unsafe for the prolonged storage of apples at low temperatures.

THOMAS (P. H.) & RAPHAEL (T. D.). **Internal cork in Apples associated with malformed wood growths.**—*Tasmanian Journ. of Agric.*, N.S., iii, 2, pp. 69–73, 4 figs., 1932.

During the winter of 1931, apples lying at the foot of an 18-year-old Sturmer Pippin tree long affected with crinkle and cork [*R.A.M.*, ix, p. 322] were found to be very badly malformed by the latter condition, which had attacked the young fruits and produced one of the worst cases of the disease ever observed in Tasmania.

The tips of the branches and spurs which had borne the affected apples were swollen and malformed. The fully matured fruits were superficially knobby and distorted, with sunken areas darker than the surrounding skin. The flesh showed considerable dark brown, irregular, necrotic areas, most prevalent round the core and seldom extending to the skin; the core and seeds were frequently only partially developed. The current wood growths appeared to be normal up to 1 or 2 in. of the tips, where they generally bore pubescent, gall-like swellings. The buds were unaffected, but the internodes near the tip were very short, the resulting crowding of the buds giving a characteristic effect. The bark was distended and sappy.

Sections of the swollen wood showed signs of cell rupture throughout, extending especially transversely along the medullary rays. Large portions of the parenchyma had failed to lignify properly, and brown areas (apparently consisting of dead cells) like those typical of bitter pit were present in the wood.

The tree, which was normally developed and growing well and had always been pruned by the short spurring or 'pole' method, was in light soil overlying yellow, friable clay. It had long been affected by this disorder, from which the surrounding trees suffered less severely.

Further investigations are in progress.

TETLEY (URSULA). **The development and cytology of the leaves of healthy and 'silvered' Victoria Plum trees.**—*Ann. of Botany*, xlvi, 183, pp. 633–652, 2 pl., 3 figs., 1932.

A full account is given of the author's comparative cytological study of the development of normal Victoria plum leaves and those which have become silvered as a result of attack by *Stereum purpureum* [*R.A.M.*, xi, p. 59] on the tree.

Observations were made on three classes of mature silvered leaves, (1) those (much smaller than healthy leaves) on trees in a very advanced stage of the disease: these became yellow and then brown very early, and fell off about July; (2) those which though deformed were more nearly normal in size: these had become yellow and brown by 2nd July, and fell early in September; (3) leaves approximately normal in size and shape but heavily silvered. These were still on the tree on 8th October, but yellowing had set in towards the end of September, followed by the appearance of small, isolated brown patches.

The cells of the mesophyll of the leaves in class (1) showed rapid nuclear and cytoplasmic degeneration. Numerous palisade cells were separated from the epidermal cells. In one leaf of class (2) the cell contents showed granular deposits completely filling many of the vacuoles, and the chloroplasts were small and contained no starch grains. In another leaf of the same class, in which the disease was less advanced, no granular deposits were present, but there was an excessive starch accumulation. A typical grey-green leaf of the third class showed much of the palisade free from the epidermis. In any one section the condition of the cell contents is extraordinarily varied, this being characteristic of all the silvered leaves which had remained on the tree until the autumn. Cells in which the nuclei became densely stained and in which the chloroplasts had disappeared were present together with cells containing chloroplasts with starch grains and normal nuclei. Among these were other cells with chloroplasts devoid of starch grains and with small, heavily staining nuclei.

All these leaves were heavily silvered. Those only moderately affected seldom show any peculiar cytological features in their mature stages, and are definitely distinguishable from normal leaves only by the separation (much less pronounced than in heavily silvered leaves) of the palisade tissue from the epidermis, and sometimes by a tendency to an undue accumulation of starch in the mesophyll.

The meristematic changes in silvered leaves indicate a retardation of the normal rate of cell division of the mesophyll, some substance probably being present in diseased leaves which partially inhibits nuclear division. In the mature tissue the nuclei show a range of behaviour which indicates that diseased leaves pass through their senescent phases rapidly and prematurely.

Smolák's observations (*Annals of Applied Biology*, ii, p. 138, 1915) that the chloroplasts of silvered leaves become corroded before they disintegrate, and that the spongy mesophyll cells of silvered leaves are longer than those of normal leaves, were not confirmed by those of the author.

The separation between the palisade and the epidermis in silvered leaves results from an inhibition of cell division in the palisade during the meristematic stage.

A bibliography of 14 titles is appended.

HUTCHINS (L. M.). **Peach mosaic—a new virus disease.**—*Science*, N.S., lxxvi, 1962, p. 123, 1932.

Most of 56 nursery peach trees grafted or budded in July, 1931, with Texas material showing symptoms suggestive of mosaic developed similar symptoms early in 1932, including shortening of the internodes, profuse growth of the leaf axil buds, and striking mosaic patterns on the leaves, which were often small, narrow, crinkled, and irregular in outline [cf. *R.A.M.*, xi, p. 521]. These symptoms appeared not only on the new growth from the aerial part of the trees but also on newly developed root suckers. The disease was communicated by inoculum from either the roots or shoots of the suspected trees. It is therefore evidently systemic.

This is believed to be the first record of an infectious mosaic on the peach. So far the distribution of the disease is believed to be limited to two orchards, and hence a thorough survey and prompt eradication of infected trees would seem to be practicable.

SMITH (F. E. V.). **Panama disease of Bananas in Jamaica.**— *Jamaica Dept. of Sci. & Agric., Microbiol. Bull.* 1, 22 pp., 1 map, 1932.

Though very strong evidence exists that Panama disease (*Fusarium cubense*) [*F. oxysporum cubense*] was present in certain parts of Jamaica as early as 1902, and it may even be indigenous, the disease was first definitely reported in 1912, when an outbreak occurred in the parish of Portland. Almost immediately after, it appeared in two other localities so remote from the first that any connexion between the outbreaks was impossible.

Owing to drastic quarantine regulations [*R.A.M.*, x, p. 43] the disease at first progressed very slowly, but from 1918 onwards, owing partly to the failure of growers to co-operate in carrying out the regulations, it steadily spread.

The original quarantine area of 4 sq. chains round each diseased plant or a corresponding area for a diseased patch has been maintained for all initial outbreaks (except in the parish of Portland where eradication has been abandoned) [ibid., xi, p. 62], though for subsequent ones the nine-root system is allowed at the discretion of the Director of Agriculture. The one-root system [ibid., xi, p. 625] is most dangerous in any land which is to be maintained in bananas, and is permitted only when the property is officially gazetted as infected and when adjacent lands are not endangered. The quarantine methods adopted have been successful in restricting the spread of the disease; 1929 was actually a record crop year though the disease had then been present at least seventeen years.

Under Jamaica conditions, Panama disease spreads very rapidly on irrigated lands [cf. ibid., x, p. 11], in some instances more rapidly than elsewhere. Soil alkalinity is no deterrent. Many of the worst outbreaks have occurred on the best lands, often soon after they have been brought into cultivation, while some poorer lands have not been rapidly infected. The better the cultivations and the richer the soil, the more rapid is the spread of the disease. In a large-scale experiment on the effect of high cultivation and first-class drainage, in which heavily infected but otherwise excellent land was replanted, over 50 per cent. of the plants became attacked in twelve months, only about 200 stems being harvested from some seven acres. Initial outbreaks have frequently followed from flooding consequent upon extending the plantations right up to the edge of the rivers.

By the end of 1931, 249,274 diseased plants had been recorded [since 1912] from parishes other than Portland, while in Portland itself 155,398 diseased plants were recorded up to the end of 1929 when recording ceased. Taking the island as a whole, the incidence of the disease increases annually by about 50 per cent., with very much greater increases locally when conditions are exceptionally favourable. The total loss of land in the last twenty

years amounts at a liberal estimate to not more than 15,660 acres out of 81,848 acres, but as the latter, official, figure for the total area cultivated is a very conservative estimate, the real proportion of land destroyed probably does not exceed one-tenth of the total under cultivation in the period. In parishes other than Portland, 6,660 out of 72,337 acres have been abandoned or destroyed, the probable loss (again allowing for the conservative official estimate of the total acreage) amounting to one-fifteenth or less of the available land. Estimating the annual rate of increase of the disease at 50 per cent., and allowing for the abandonment of numerous riverside plantations, it is unlikely that the output will be seriously affected before 1936.

The solution of the banana wilt problem in Jamaica depends entirely on the rapid development of a marketable immune variety. In this connexion, the seedlings raised by Mr. Sutherland [ibid., xi, p. 625] are of the highest promise. Every effort should be made also to develop secondary crops, especially citrus.

BECZE (G. v.). **Beiträge zu den während des Transportes und während der Reifung auftretenden Fäulniskrankheiten der Bananen.** [Contributions to the study of the Banana rots occurring during transport and ripening.]—*Zentralbl. für Bakt.*, Ab. 2, lxxxvi, 16–18, pp. 381–399, 7 figs., 1932.

During the period from July to October, 1931, the writer inspected consignments of bananas arriving at Hamburg from the Cameroons, Fernando Po, the Canary Islands French Guinea, Brazil, and the West Indies. The fruit consisted mainly of Gros Michel (*Musa sapientum*) with some lots of *M. cavendishii* from the Canaries. The losses occurring from decay in storage at the port amounted in some consignments to between 20 and 25 per cent.

The rots are divided into seven groups according to the parts of the bunch affected. Infection and the factors in its causation are briefly discussed under the headings of spores, wounds, air and humidity, and temperature. The fungi found on the diseased organs were *Gloeosporium musarum*, *Thielaviopsis* [*Ceratostomella*] *paradoxa*, *Oidium lactis* f. *musarum* n. f. from Brazil and the Canaries, *Fusarium semitectum* Berk. et Rav., var. *majus* Wr. (the most prevalent after *G. musarum*), *F. aquaeductum* Lagh. non Radlk. et Rabenh. [see below, p. 58], *Gibberella saubinetii* from Brazil and the Canaries, *Verticillium* spp., including *V. albo-atrum* and *V.* (?) *candelabrum*, the latter on *M. cavendishii* from the Canaries, *Helminthosporium torulosum* [*R.A.M.*, xi, p. 464], *Cercospora kopkei* [ibid., xi, p. 205] from Jamaica and Brazil, *C. longipes* [ibid., ix, p. 808] from Brazil, *H. sacchari*, *Colletotrichum falcatum* on a few plants from Brazil, *Macrophoma musae*, *Vermicularia* [*Colletotrichum*] *dematium*, *Botryodiplodia theobromae*, *Cephalothecium* [*Trichothecium*] *roseum*, *Pestalozzia leprogena*, *Albugo* sp., *Alternaria* sp., and *Aspergillus wentii*, while secondary infections were caused by *Cladosporium herbarum*, *Penicillium crustaceum*, *Mucor mucedo*, *Rhizopus nigricans*, *Saccharomyces* sp., *Torula variabilis* and *T.* spp.

O. lactis f. *musarum* was highly destructive to the fruits, entire bunches of which decayed rapidly as a result of infection and become covered in moist air with a white felt of radiating hyphae. Stems or fruits attacked in the green or semi-ripe stage soon became moist and soft. The spore (oidia) dimensions were 8 to 20 by 4 to 6 μ.

Young (W. J.), Bagster (L. S.), Hicks (E. W.), & Huelin (F. E.). **The ripening and transport of Bananas in Australia.**—*Australia Council Sci. & Indus. Res. Bull.* 64, 52 pp., 4 graphs, 1932.

In this bulletin a full report is given of the transport and ripening of bananas as practised in Australia, with details of experimental work and recommendations of improved methods. In a section on the diseases of the fruit during ripening and transport observations are made on black end [*R.A.M.*, viii, p. 256; x, p. 44] associated with *Verticillium* sp., *Gloeosporium musarum*, and *Fusarium* spp.; the more serious stem-end rot which usually begins in transit when the fruit is hard and green, the pulp under the affected skin becoming soft, watery and evil-smelling; anthracnose (*G. musarum*: ibid., v, p. 377]; and squirter [ibid., xi, p. 794].

Simmonds (J. H.). **Powdery spot and fruit scab of the Passion Vine.**—*Queensland Agric. Journ.*, xxxviii, 2, pp. 143–152, 7 figs., 1 graph, 1932.

The powdery spot and fruit scab of passion fruit (*Passiflora edulis*) caused by an undetermined *Cladosporium* [*R.A.M.*, x, p. 394] in Queensland affects only the younger terminal shoots and fruit, first appearing on the leaves as a small, circular, translucent spot having a narrow, faintly brown border and attaining up to 6 mm. in diameter. Subsequently the spot becomes grey and powdery owing to fungal fructification. Similar spots may occur on the sepals, and brown sunken areas, generally partly filled with a powdery mass of spores, on the younger parts of the runners, petioles, and tendrils. On the fruit minute, light brown, slightly depressed, circular dots appear and gradually reach 2 to 3 mm. in diameter, the margin at the same time becoming raised and producing a crater-like effect. At this stage the outer layers of the rind constitute a thin shell covering a small cavity due to disintegration of the parenchyma, and under favourable climatic conditions this covering may bear a thick dusky coat of spores resembling that on the leaf lesions. Later, vertical growth is stimulated below the excavation, so that the corky lining becomes raised into a dome-shaped or fissured scab 1 to 3 mm. high. By this time, virtually all trace of the fungal origin of the condition has disappeared.

The sclerenchymatous cells adjacent to the invaded region degenerate and lose much of their thickness, until they become scarcely distinct from the parenchyma. Before this destruction has progressed more than a millimetre or two inwards, the cells below the excavation take on a meristematic function, and

eventually a definite phellogen appears. From this a few corky layers are produced on the outside, and from the inner side definite radial rows are formed of tissue consisting largely of sclerenchymatous elements, the continuous formation of this latter tissue rupturing the covering veil and producing the scabby excrescence. Fruit infection usually occurs during the early stages of growth, but the raised scab may not reach its full dimensions until after the fruit has attained its full diameter. Slight deformity of the mature fruit may accompany the presence of one or more scabs owing to the growth of the rind tissue round the point of infection becoming restricted.

Infection is quickly followed by defoliation of the younger terminal leaves, and during an epidemic the runners may be spotted or girdled up to 12 in. back, the shoots wilting and dying back in consequence. Powdery spot is most serious on vines up to two years of age.

When young leaves were inoculated in the laboratory in moist conditions between 15° and 25° C. with the *Cladosporium* associated with the disease typical lesions were produced, and the fungus was reisolated.

Two types of spores were found (sometimes in the same chain) both in nature and in culture. The more common form was oval or elliptical, continuous, and averaged 6·1 by 3·9 μ, while the other was more elongated (average 13·7 by 4·2 μ), almost cylindrical, continuous or uniseptate. The same disease was also found on *P. herbertiana*, the average spore measurements of the two types on this host being 6·3 by 3·7 μ and 11·6 by 4 μ, respectively. A similar powdery leaf spot without any fruit scab was noted on *P. alba*, but the cultural characters of the *Cladosporium* associated with the condition suggested that it was distinct from that found on the other two hosts, and the average spore measurements were 6·5 by 4 μ and 11 by 4·3 μ, respectively.

Powdery spot does not usually become prevalent until April, infection reaching its peak in June and July. The foliage symptoms become less abundant as the weather grows warmer, but the fruit may exhibit scabs (the result of earlier infection) in November. Occasionally an early setting of summer crop fruit may also become scabbed. The maximum growth temperature for the *Cladosporium* is 28°, while the optimum is from 20° to 22°. The restricted distribution of powdery spot, which has only been found in two widely separated districts, is evidently due to the cool, moist conditions required by the fungus.

The control measures recommended are similar to those advised against the brown spot due to *Macrosporium* sp. [loc. cit.], except that the vines must be sprayed with Bordeaux mixture from April to August. Special attention should be paid to spraying the young foliage and fruit, vines up to 2 years of age requiring most care.

CUNNINGHAM (G. H.). **Orchard sprays in New Zealand. III. The copper series.**—*New Zealand Journ. of Agric.*, xlv, 1, pp. 33–39; 2, pp. 70–77, 1932.

In this, the third communication of this series [*R.A.M.*, xi,

p. 655], the author deals with the various cupric fungicides in use in New Zealand for the control of orchard and vineyard diseases, the greatest space being given to the preparation and application of Bordeaux mixture, which is considered to be the most important. The other sprays briefly discussed are Burgundy mixture, cuprammonium spray, Cheshunt compound, copper acetate, colloidal copper hydroxide, and copper sulphate solution. Copper-lime dusts have proved worthless in New Zealand trials, besides frequently causing severe injury to the plants and costing from three to five times as much as the comparable Bordeaux sprays. A separate section discusses the effects of the sprays upon the parasites and the hosts, and the whole ends with some recommendations for the use of the sprays.

Newhall (A. G.) & Chupp (C.). **Soil treatments for the control of diseases in the greenhouse and the seedbed.**—*Cornell Agric. Exper. Stat. Extens. Bull.* 217, 59 pp., 20 figs., 7 diags., 1931. [Received September, 1932.]

Directions are given for soil sterilization against greenhouse and seed-bed diseases in New York State by various methods, with notes on installation and costs. The methods include steam sterilization by 'buried tiles' (a series of trenches 13 to 16 in. deep and 18 in. apart, in which ordinary clay drain tiles (pipes) are closely laid end to end, fed by one or two 'header' pipes delivering steam from a 100 h.p. boiler, thereby raising the soil temperature to 160° F. in three to six hours); the buried perforated pipe (a modification of the former); the inverted pan [*R.A.M.*, viii, p. 276]; dry heat (surface burning and English ovens); boiling water (for pots only); various chemical treatments, including formaldehyde, acetic acid, lime, carbon bisulphide, sulphur and its compounds, copper and mercury compounds; and electric light (Mazda lamps of 200-watt power suspended 2 ft. above the seedlings).

Smith (K. M.). **Filtration of plant viruses.**—*Nature*, cxxx, 3276, p. 243, 1932.

During the past nine months the writer has been filtering the two potato mosaic viruses, *x* and *y*, by means of W. T. Elford's collodion membrane technique [*R.A.M.*, xi, p. 735]. Preliminary experiments showed that, while the *x* virus was filterable through an L_3 and occasionally, an L_5, Pasteur-Chamberland candle, the *y* virus would not pass the L_1 size. Similar tests with collodion membranes indicated that both viruses would pass a membrane of the approximate pore size 0·35 μ, while both are held back at 0·15 μ. The incapacity of the *y* virus to pass the L_1 candle is attributed to the adsorption of the former by the latter, rather than to the porosity of the candle or the size of the virus particle. It has been found that if the virus complex, $x+y$, is passed through a kieselguhr bed in a Buchner funnel, the filtrate invariably contains a 'pure culture' of the former virus, the latter being completely adsorbed by the kieselguhr; this offers a simple means of separating out a complex of the two viruses.

Matsumoto (T.) & Somazawa (K.). **Immunological studies of mosaic diseases. II. Distribution of antigenic substance of Tobacco mosaic in different parts of host plants.**—*Journ. Soc. Trop. Agric.*, Formosa, iv, pp. 161–168, 1932. [Japanese summary.]

It has been shown that the leaf extract of tobacco mosaic can stimulate the production of specific precipitating antibodies when injected into a rabbit [*R.A.M.*, x, p. 563]. Further studies were made to determine whether such antigens occur in the parts of infected plants showing no recognizable mosaic symptoms, and how they are formed and spread.

All parts of the diseased plants were found to contain the specific antigen, even when there were no symptoms. Root extracts caused the production of specific antibodies when injected into rabbits.

The concentration of the antigenic substance was measured in the different parts of infected plants. Antigenic activity was found to be highest in dried leaves and about equal in the expressed juices of fresh leaves and of fresh and dried roots. In stems, especially dried ones, the antigenic concentration was very low, notwithstanding the fact that heat desiccation produced no injurious effect on antigenic activity.

Tests carried out to ascertain whether the formation of the antigen takes place parallel with the multiplication of the infective agent showed that no noticeable reaction followed the use of juices prepared from portions of inoculated plants until four or more days after inoculation. The antigen was distinctly recognizable in the apical and subterranean portions of the plants before mosaic symptoms appeared. In a series of tests to determine the distribution of the antigen in various parts of the plants, it was found to appear in the portions above the point of inoculation four days after the operation, the underground parts developing it later.

It is inferred that the antigenic reaction is actually due to the infective agent and not to modifications of the host protein [ibid., xi, p. 406].

Plantenga (Maria H. J.). **Pathologische veranderingen in het phloem.** [Pathological alterations in the phloem.]—Thesis, University of Utrecht (Hollandia- Drukkerij, Baarn), 108 pp., 26 figs., 1932. [English summary.]

In connexion with a study of the phloem necrosis of coffee in Surinam [*R.A.M.*, xi, p. 637], the writer's attention was drawn to the need for further investigations on this condition in a number of other plants. In the present paper a comprehensive account is given of her recent anatomical researches in Holland on the pathological changes induced by various agencies in the phloem of beech, lime (*Tilia europaea*), *Phlox suffruticosa*, *Vitis gongyloides*, tomato, and coffee (*Coffea arabica*).

The swelling of the cell walls accompanying phloem necrosis occurs in beech, lime, *P. suffruticosa*, coffee, and *V. gongyloides*

after ringing or other forms of wounding; as a sequel to fungous infection in beech, lime, and tomato; after the injection of chemical solutions (hydrochloric acid, oxalic acid, or sodium hydroxide) in beech and lime [ibid., ix, p. 81]; and following the injection of the metabolic products of the canker-forming fungi *Nectria galligena* var. *major* [ibid., vii, p. 677] or *Myxosporium carneum* in beech. The swelling of the cell walls begins simultaneously in all parts of the wall in beech, lime, tomato, and coffee, while in *P. suffruticosa* and *V. gongyloides* the corners of the cells first become involved. The pathological alterations are more marked above than below a wound in beech and *V. gongyloides*, whereas in *P. suffruticosa* and coffee the reverse is the case. In beech wounding causes a more extensive swelling of the cell walls than fungous infection, while in lime the results are identical in both.

Beech branches were inoculated with pure cultures of *Stereum hirsutum*, *S. rugosum* [ibid., x, p. 70], *Asterosporium hoffmanni*, *Pleurotus ostreatus*, *N. galligena*, *Pholiota aurivella* [ibid., vii, p. 292], *Polyporus squamosus* [ibid., ix, p. 81], and *Phlebia aurantiaca*, all of which produced more or less pronounced anatomical modifications. The fungi inoculated into lime branches were *Pleurotus ostreatus*, *Polyporus squamosus*, *N. cinnabarina*, *Collybia velutipes* [ibid., x, p. 632], and *Pyrenochaeta* sp., of which the last three produced the most striking necrotic symptoms, comparable to those consequent on wounding. The intraxylar phloem and the phloem parenchyma of tomato stems inoculated with *Diplodina* [*Didymella*] *lycopersici* [ibid., xi, p. 809] underwent far-reaching changes, including swelling and yellowish-brown discoloration of the cells, which were filled with gum; the extraxylar parenchyma and cambial cells were also affected to a slighter extent. This type of phloem necrosis presents a close analogy with that occurring in potato plants suffering from leaf roll [ibid., xi, p. 121]. The wood vessels of *Phlox suffruticosa* inoculated with *Phoma phlogis* Roum. were found to contain mycelium and gum, but no modifications of the phloem or cortical parenchyma were apparent.

The swelling of the cell walls associated with fungous infection in beech was observed to be more prominent in the summer than in winter, whereas with wounding the opposite was the case. Gummosis is more active in summer than in winter both in beech and lime, and in beech, lime, tomato, and coffee the swollen cell walls become infiltrated with gum after the cell-contents have developed gummosis. Lignification of the swollen cells was found to occur in beech and *P. suffruticosa*. In lime and beech phloem necrosis is more severe in the younger parts, while in *V. gongyloides*, tomato, and coffee the older portions are chiefly affected. After three to five months phloem necrosis only extends for a few inches above and below a wound or site of infection or injection in beech and lime; the site of infection in tomato; and a wound in coffee. Wounded or infected branches of lime form a great deal more parenchymatous traumatic tissue between the diseased phloem and the cambium than those of beech.

A bibliography of 75 titles is appended.

MINKEVIČIUS (A.). **Untersuchungen über den Einfluss der Narkose auf die Pilzempfänglichkeit der Pflanzen.** [Investigations on the influence of narcosis on the susceptibility of plants to fungous infection.]—*Phytopath. Zeitschr.*, v, 2, pp. 99–152, 3 figs., 11 graphs, 1932.

Cauliflower (Le Cerf variety) and Klosterfrauen bean (*Phaseolus vulgaris*) seedlings were grown in pots in frames made of eterniet (a mixture of cement and asbestos) [*R.A.M.*, x, p. 598] and exposed to fungous infection under the influence of narcotics (chloroform, ethyl ether, and ethyl alcohol) for periods of 10 minutes to 84 hours at varying doses with a temperature range of 12° to 24° C. [cf. ibid., x, p. 479]. The fungi used for artificial inoculation were *Alternaria brassicae* for the cauliflowers and *Uromyces appendiculatus* for the beans. The atmospheric humidity in the frames fluctuated between 75 and 95 per cent., and each frame was lighted by a 1,000-Watt Osram-Nitra lamp (extinguished during the night in the longer tests). Sixty plants were used for each experiment (ten in each of six frames, of which three served as controls). The inoculations were carried out either shortly before or immediately after narcotization with spore suspensions in tap water, to which 0·1 per cent. gelatine was added to facilitate adhesion to the cauliflower leaves. Details are given of the construction of the incubation chambers in which the plants were placed after treatment, and also of the statistical methods used in calculating the degrees of infection obtained.

The results of the experiments [which are fully discussed and tabulated] showed that the susceptibility of the cauliflower plants to *A. brassicae* was not appreciably affected by narcotization with chloroform (applied in doses ranging from 42 to 45 c.c. per cu. m. of air for 84 hours to 95 to 98 c.c. for 10 minutes), except for a marked increase of infection induced by prolonged exposure (48 hours) to a relatively strong concentration (65 c.c.). The growth of the plants was distinctly accelerated by treatment with chloroform. Ethyl ether (680 to 710 c.c. per cu. m. for 48 and 725 to 760 c.c. for 12 hours) and ethyl alcohol (16 to 20 c.c. for 84 and 30 to 33 c.c. for 12 hours) also failed to influence the reaction of the plants to the fungus. Ether slightly stimulated plant growth, while alcohol was indifferent in this respect also. On the other hand, the susceptibility of the bean plants to *U. appendiculatus* decreased under the influence of protracted exposure (12 hours or more) to chloroform, applied in doses of 62 to 66 c.c. per cu. m. The decrease in the incidence of infection was correlated with a check to the growth of the plants. Similar results were obtained with ether (610 to 645 c.c. for 12 and 715 to 740 c.c. for 2 hours) and alcohol (27 to 29 c.c. for 12 and 33 to 36 c.c. for 2 hours).

It is apparent from these results that the influence of narcotization differs with the two fungi. It is concluded that whereas the only case of increased infection on cauliflower plants (those exposed for 48 hours to the highest concentration of chloroform used for this length of exposure) was evidently due to the effect of narcotization on the spores of *A. brassicae*, the differences in susceptibility of the treated and untreated bean seedlings to *U. appendiculatus* depend

exclusively on the influence of narcosis on the plants and not on the fungus.

TOMKINS (R. G.). **The action of certain volatile substances and gases on the growth of mould fungi.**—*Proc. Roy. Soc. London*, Ser. B., cxi, B771, pp. 210–226, 11 graphs, 1932.

This is a full account of experiments to test the action of certain volatile substances and gases on the growth in pure culture of *Trichoderma lignorum* and various other fungi, including *Rhizopus nigricans*, *Thielaviopsis* [*Ceratostomella*] *paradoxa*, *Gloeosporium musarum*, and *Botrytis cinerea*, a preliminary report on some of which has already been noticed [*R.A.M.*, xi, p. 63]. It was shown that germination and the initial growth of *T. lignorum* were very slightly delayed in the presence of acetone, but much more in that of acetaldehyde, this effect being in part due to differences in the action of the substances on the time required for germination, i.e., the latent period of germination. The rate of increase in the size of the colonies remained constant at the various concentrations of acetone, but in the case of acetaldehyde it increased as the colony grew larger. Transference from pure air to the presence of acetone resulted in a rapid reduction of the growth rate to a value determined by the concentration of the substance, which subsequently remained constant, independently of the size of the colony before transfer. When transferred to the presence of acetaldehyde, the rate of growth was immediately decreased or was even stopped; it did not, however, remain at the initial low value, but increased with the time of exposure up to a certain value which then remained constant, the whole process of initial reduction and subsequent recovery of growth depending on the size of the colony before transference. The concentration of acetaldehyde needed to inhibit germination was less than that required to inhibit growth.

Chloroform, ether, ethyl alcohol, formaldehyde, and amyl formate retarded the growth of *T. lignorum* in a manner similar to acetone; propionaldehyde and butyraldehyde, on the other hand, acted like acetaldehyde. The concentration in the atmosphere of the volatile substances needed to inhibit germination and growth varied with the temperature, being higher at the higher than at the lower temperatures tested.

Sulphur dioxide retarded the growth in a manner similar to acetone, in that it did not delay germination compared with that in the air, and the rate of growth did not increase as the colony grew in size. At first, after transference to its presence, the rate of radial spread decreased, owing, it is believed, to the slowness with which the sulphur dioxide absorbed by the agar comes into equilibrium with that in the atmosphere; this view is supported by the differences in the rate of decrease which were observed when the gas was renewed at varying intervals of time. On the other hand, hydrogen cyanide and hydrogen sulphide acted like acetaldehyde in that the latent period of germination was prolonged, the growth rates following germination were much reduced, but increased as the colonies grew, and the concentration required to inhibit growth was greater than that needed to inhibit germination. On transference from air to their presence, the growth rates

were at first reduced, and then increased to a constant value. The action of ammonia differed from that of the substances above mentioned in that it prolonged the latent period of germination very considerably, and the same concentration was needed to inhibit germination as to inhibit growth.

The reaction of the other fungi tested to the various volatile substances and gases was very similar to that of *T. lignorum*.

EYRE (J. C.). **Cultural studies on the Aspergilli, with special reference to lipase production of strains isolated from stored Copra and Cacao.**—*Ann. of Appl. Biol.*, xix, 3, pp. 351–369, 1932.

The experiments briefly reported in this paper had for their purpose to determine the production in pure culture of lipase by nine (named) species of *Aspergillus* and also by *Mucor racemosus*, *Syncephalastrum cinereum*, and a blue-green species of *Penicillium*, all of which were isolated from stored copra and cacao beans [cf. *R.A.M.*, xi, pp. 175, 285]. The results [presented in tabular form] showed that all the species and strains of *Aspergillus* produced lipase in their mycelium, and diffused it into the liquid nutrient medium, and that they fall, on the base of the amount of the enzyme excreted into the medium, into two classes, *A. flavus* (a light-coloured strain), *A. tamarii*, *A. sydowi*, and *A. ochraceus* producing considerably more than the others (which included a dark strain of *A. flavus*). While the lipolytic activity of the dried mycelial mats and of the medium was materially the same at the end of two weeks as of four weeks of growth, at the end of eight weeks determinations showed an increase in the activity of the medium and a decrease in that of the dried mats; this suggests that the increased lipolytic activity of the medium is due to autolysis of the organisms, and probably to an increased excretion of lipase. *A. fumigatus* and the dark coloured strain of *A. flavus* contained more lipase in the dried mould than in the medium. The production of the enzyme appeared to be stimulated when coco-nut oil was substituted for sucrose as the source of carbon.

The lighter-coloured forms of *Aspergillus* produced least acid and most colour in the medium. On autolysis the depth of colour of the medium increased, and its titratable acidity decreased. The four strains of *A. niger* tested differed markedly in the titratable acidity they imparted to the medium; and increase of temperature enhanced these differences, and also brought forth differences in the lipolytic activity of the strains.

Coco-nut oil emulsion was clarified in the shortest time by the *A. niger* strain from copra and by the light-coloured strain of *A. flavus*; the addition of sucrose considerably delayed the clarification of the emulsion.

MURPHY (P. A.) & M'KAY (R.). **A comparison of some European and American virus diseases of the Potato.**—*Scient. Proc. Roy. Dublin Soc.*, xx (N.S.), 27, pp. 347–358, 1932.

This is a brief account of the results so far obtained by the authors in the comparative study of European and American [cf.

R.A.M., xi, p. 739] virus diseases of the potato, as judged by the symptoms caused by individual diseases of either origin when introduced into healthy (i.e., virus-free) President plants. It is pointed out that the work was from the outset greatly hampered by the presence in practically the whole of the American material (both 'healthy' and obviously diseased) of a latent virus or virus complex which had a severe necrotic effect on President, interfering with the development of symptoms attributable to the American disease studied. The results indicated, however, that on the two continents leaf roll, aucuba mosaic, and interveinal mosaic are identical, and that the condition known in Scotland as 'wilding' [ibid., iv, p. 437] is due to a virus and is identical with the American witches' broom. While European simple mosaic (Quanjer's common mosaic) [ibid., iii, p. 415] has not been described from America, the investigation showed that it is of common occurrence in apparently healthy American material, on which, when grown in the field, it produced symptoms similar to those on European varieties; it is believed that this disease may probably be equivalent to the American 'healthy potato' virus. It differs from the American mild mosaic which corresponds more nearly to European crinkle [ibid., xi, p. 739]; the latter is not identical with American rugose mosaic. A streak disease similar to Up-to-date streak [ibid., xi, p. 738] was common in the American 'healthy' and diseased plants, while the American streak was found to be a different disease. Leaf rolling mosaic may have affinities with European para-crinkle [ibid., ix, p. 604]. The identity of the remaining American virus diseases, namely, crinkle mosaic, spindle tuber, giant hill, yellow top, and yellow dwarf [ibid., xi, p. 743], with European diseases was not established in the experiments so far carried out.

BARTON-WRIGHT (E.) & M'BAIN (A.). **Studies in the physiology of the virus diseases of the Potato: a comparison of the carbohydrate metabolism of normal with that of leaf-roll Potatoes.**—*Trans. Roy. Soc. Edinburgh*, lvii, ii (11), pp. 309–349, 16 graphs, 1932.

A full account is given of the authors' investigations under controlled conditions on the mode of carbohydrate formation and the nature of the translocatory sugars in healthy and leaf roll Arran Victory and President potato plants. Special virus-free units were used for control purposes. The disease was transmitted by sprout infection with *Myzus persicae*, which was uniformly successful [*R.A.M.*, iii, p. 161; xi, p. 667].

Variations in the carbohydrate content of the leaf blades and petioles of normal and diseased plants were followed at hourly intervals over 19 and 20 hours at different times (early and late) in the growing season, fluctuations in radiation and temperature being measured at the same time. The carbohydrates estimated in the laminae and petioles were reducing sugars (glucose and fructose), sucrose, and starch. The results were calculated as a percentage of the residual dry weight (dry weight less total carbohydrates). In healthy plants hexose and not sucrose was the first sugar of photosynthesis; the latter is the sugar of translocation and a high degree

of correlation exists between its presence in the leaf blades and in the petioles. In the 'secondary' stage of leaf roll which develops more rapidly in President under greenhouse conditions than in Arran Victory, photosynthesis was found to be much reduced in the early part of the growing season, the main reactions in the laminae being the conversion of starch to hexose, hexose to sucrose, and sucrose back to starch. The same reactions are operative in the leaves of plants in the 'primary' stage of the disease, in which photosynthesis is not reduced to the same extent as in the 'secondary'. In primary leaf roll there is a correlation between the presence of hexose in the leaf blades and in the petioles, so that this substance is the translocatory sugar in diseased plants. Hexose and starch were further found to be directly correlated in the petioles of leaf roll plants, the former apparently travelling down the ground parenchyma and not down the phloem as in normal individuals. Sucrose is absent from the petioles of diseased plants at all times of the day and night, and plays no part, therefore, in the translocatory process. Later in the growing season the starch content of leaf roll plants was found to be much reduced, while photosynthetic activity had increased.

Leaf roll was found in these investigations considerably to reduce the yield of tubers, especially in the very susceptible President, the ratio of healthy to leaf roll tubers being 11·4 : 1 in this variety compared with 1·2 : 1 in Arran Victory. In addition to the prevention by phloem necrosis of free translocation of food materials to the tubers, the absence of sucrose (a highly efficient agent of starch formation) may be involved in the small yields of leaf roll plants.

HARRINGTON (F. M.). **Tuber indexing versus tuber-uniting and roguing in seed Potato production.**—*Amer. Potato Journ.*, ix, 8, pp. 128–131, 1932.

Near the Montana Agricultural Experiment Station two potato plots are maintained for growers' seed stocks, one on dry land and one irrigated. Disease readings are made on all the stocks and yield records taken. During the past exceptionally dry season, the readings in the dry land plot were almost impossible to make, especially in respect of mosaic, whereas in the irrigated plot the diseases were readily identifiable and were further found to have spread even in the apparent absence of aphids.

For a number of years tuber-unit plots of Bliss Triumph and Netted Gem potatoes have been maintained, thorough roguing being carried out annually. It was found impossible, however, completely to eradicate virus diseases on the dry land plot by this method, and tuber indexing was therefore begun. The first season's work showed a remarkably high percentage of disease, chiefly mild mosaic. The tuber-indexed stock was planted back in the field and compared with a non-indexed one, with the result that a marked difference was recorded in favour of the former. Tubers from the indexed field were again indexed the following winter, and showed a very low disease reading compared with the first [cf. *R.A.M.*, xi, p. 667].

On the basis of these investigations the writer concludes that

the work of tuber indexing cannot be conducted by the grower alone, but requires the co-operation of the experiment stations. The Montana scheme is to return to the grower, every year or two years as space permits, a certain quantity of tuber-indexed seed stock. The grower will plant this stock in an isolated tuber-unit seed plot, where it will be carefully rogued, and whence supplies will be sent either direct to the commercial field or to a tuber-unit increase plot, also under special observation.

Brann (J. W.). **Some results of Potato indexing in Wisconsin.** —*Amer. Potato Journ.*, ix, 8, pp. 136–140, 1932.

Some 300,000 bushels of much improved Triumph seed potatoes have been produced by Wisconsin growers through the use of seed stock purified by the tuber-index method [see preceding abstract]. Before this service was instituted eight years ago by the horticultural department of the State experiment station, the inability of the growers to eliminate crinkle mosaic constituted an obstacle to certification. The total number of bushels indexed from 1923 to 1930, inclusive, was 1,085, the yield from the first year's increase stock being 16,800 and from the second 263,000 bushels, respectively. Since the introduction of tuber-indexing there has been a steady decline in the incidence of mosaic, the percentage of applicants for certification in the 0 to 2 per cent. group in 1931 being 96 compared with 18 in 1926, while no applications in the 6 to 10 per cent. class were made since 1928.

The actual work of indexing is begun about 20th November, when each tuber is numbered and one eye piece $1\frac{1}{4}$ in. in diameter and $\frac{1}{2}$ in. deep removed from the stem end. The germination of the seed pieces in pots in the greenhouse is accelerated by raising the temperature to between 70° and 75° F.; after the emergence of the plants this figure is reduced to 60°, at which point it is maintained during the growing period. Disease records are taken when a height of 6 to 8 in. is reached, and the balance of the healthy tubers returned to the grower for planting in a tuber-unit seed plot, while the diseased ones are removed. Some of the more experienced growers send numbered eye pieces instead of tubers, strung in consecutive order in groups of 10 to 20. This method reduces the risk of frost in transit and the cost of labour in handling the tubers. The practice of indexing one or more tubers from selected hills has also been followed, and has given good results where relatively mosaic-free stock is used.

Hintikka (T. J.). **Über die Verbreitung des Kartoffelkrebses in verschiedenen Ländern sowie über einige klimatischen Faktoren der verseuchten Gebiete.** [On the distribution of Potato wart in different countries and on some climatic factors of the infested areas.]—*Valtion Maatalouskoetoiminnan Julkaisuja* 23, 102 pp., 11 maps, 1929. [Finnish, with German summary.]

The writer has examined the available literature on wart disease of potatoes (*Synchytrium endobioticum*) with a view to elucidating the factors (especially climatic) concerned in the distribution of the fungus in different countries. Two groups of factors are dis-

tinguished, endogenous and exogenous. In the former are included the origin of the fungus and its parasitic adaptation to various hosts. Present-day knowledge tends to support the view that *S. endobioticum* is probably indigenous to Europe, whence it has been conveyed to North America and South Africa.

Varietal reaction to the fungus is another important aspect of the endogenous factor-group. A list is given of recognized immune varieties, arranged under their countries of origin, with a discussion of their synonymy and of the conflicting results sometimes obtained with regard to susceptibility and resistance in different countries [cf. *R.A.M.*, x, p. 544 ; xi, p. 71] An account is given of the genetic studies that have been carried out on varietal reaction, with observations on the dependence of infection on the degree of contamination of the soil and other subsidiary factors.

Among the exogenous factors governing the occurrence of *S. endobioticum* are included the effects of soil, light, warmth, and moisture, and the dissemination of the fungus by human and animal agency, as well as through unsuitable methods of cultivation, e.g., in mining and industrial centres and allotments, where the dense population and lack of crop rotation favour epidemic infection.

In Finland potato wart occurs only in the districts with the heaviest rainfall, i.e., an annual mean of 650 mm., and is thus confined to the south-west [ibid., x, p. 620] notwithstanding the absence of all restrictions on imports since 1926. The disease is most prevalent in Germany (1,039 localities) in areas with a mean annual rainfall of over 70 cm., the corresponding figures for the averages of 60 to 70, 50 to 60, and 50 cm. or below being 360, 276, and 3, respectively. In Poland potato wart has been detected in a sporadic form in areas with a comparatively low rainfall (eight with an annual mean of 500 to 600 mm. and one or two below 500). Hornyan, Czecho-Slovakia, where *S. endobioticum* was discovered in 1896, is situated in a region where the annual precipitation amounts to between 600 and 700 mm. or exceeds the latter figure, and all the centres of infection recorded in that country up to the end of 1924 were in areas of relatively heavy rainfall. Similar conditions are stated to obtain also in Austria, Switzerland, France, Belgium, Holland, and Great Britain and Ireland. The average rainfall in the Danish infected areas exceeds 650 mm., while in Norway (with one possible exception) precipitation is also rather heavy in the affected localities. In Sweden, on the other hand, the disease occurs in comparatively dry districts. In the United States [ibid., iv, p. 239] and South Africa [ibid., v, p. 444] infection is found in areas with a very high mean annual rainfall. It is apparent from these data that humid conditions are of primary importance, though not absolutely essential, to the development of *S. endobioticum*.

With regard to temperature extremes, it appears that the coldest European centres of infection in Finland and Sweden lie within the isotherms of 3° to 4° C., while the warmest may be placed at 20°, south of which point wart disease is found only in the mountains or in very rainy districts. The climatic type in which the fungus

flourishes is evidently North Atlantic, characterized by relatively cool and damp summer weather, especially in July and August.

NAPPER (R. P. N.). **Observations on the root disease of Rubber trees caused by Fomes lignosus.**—*Journ. Rubber Res. Inst. Malaya*, iv, 1, pp. 5–33, 1932.

In this progress report of experiments in Malaya, commenced by Dr. J. Weir and continued and extended by the writer, on the root disease of *Hevea* rubber trees caused by *Fomes lignosus* [*R.A.M.*, xi, p. 672], it is stated that fructifications of the fungus bearing numerous viable spores are produced abundantly under certain normally recurring climatic conditions which last for considerable periods. Wind-borne infection is therefore highly probable.

Experiments to compare the incidence of the disease in soil which has been cleared of stumps and surface roots (clean-cleared) and where these have been left to rot in the ground (uncleared), respectively, gave results entirely at variance with the ideas prevalent on the subject when they were begun. The first showed that with trees up to three years of age uncleared conditions considerably reduced infection, the figures for per cent. potentiality of attack (100 times the total number of planting holes where *F. lignosus* has developed since planting, divided by the total original stand) for the uncleared and cleared areas being, respectively, 18·6 and 29·4. In a second test the corresponding figures were 9·2 and 20·3, and infection was also found to be less in the areas carrying cover crops than in areas without cover. In a third experiment infection remained negligible in an area (adjoining a highly infected block) in which secondary jungle ('belukar') was allowed to grow up among the rubber trees; when the rubber was three years old the *Fomes* incidence (100 times the number of diseased trees, divided by the total original stand) was only 1·7 per cent., a much smaller figure than that of any other three-year-old field on the station. The curve obtained by plotting the incidence of *F. lignosus* in a young clearing against the amount of timber left in the soil after clearing shows that as the amount of timber left increases from zero, the incidence of infection rises sharply from zero to a maximum and then falls gradually away, until where secondary jungle is allowed to develop, the amount of infected rubber becomes very slight.

To explain these results three postulates are made. (1) That the presence of infection in the soil of a clearing is due chiefly to the presence of the disease in the jungle stand before felling. (2) That the distribution of the disease in the future rubber stand is governed by the original distribution in the jungle, a conclusion which follows from the first. (3) That the fungus does not begin to form rhizomorphs until the food material in the substratum begins to be exhausted. This postulate is supported by general mycological considerations and by observation.

From these postulates the following deductions may be made. (*a*) If all the timber is removed before planting, all danger of infection in the clearing is eliminated. (*b*) If a small amount of generally distributed material is left in the soil, the distribution of infection will be the same as if no material has been removed,

little food will be available for the fungus, and will quickly be exhausted, and rhizomorphs will soon form and progress through the soil until their source of origin is exhausted or they encounter rubber roots, no other material being present to interrupt their progress. The chances of attack upon the young rubber will therefore be considerable. (*c*) If an increasing amount of timber is left in the soil at planting, the food available to the fungus will increase and the formation of rhizomorphs will be delayed. When the rhizomorphs are formed, there will be an increasing amount of timber other than rubber roots in the soil, on which they can feed. In these conditions the chances of attack by *F. lignosus* on the young rubber will be progressively fewer. (*d*) If secondary jungle is allowed to regenerate in a young clearing, the proportion of soil-borne timber belonging to the crop plant will be very small compared with the total amount of material which the fungus can attack. The probability of attack on the crop plant will then be slight.

If sound, these arguments explain why a woody cover crop parasitized by *F. lignosus* reduces the incidence of infection on the rubber trees among which it is planted, the cover crop presenting an enormous amount of food material on which the fungus can feed.

The evidence obtained also suggests that as the rubber tree grows older, the resistance of the roots to *F. lignosus* increases, and that in the soil of a new clearing the fungus stales after a time (this happens in experimental boxes after two or three months). Under jungle conditions *F. lignosus* is probably checked by staling, but the upheaval occasioned by felling and burning favours its development. This may explain why it has an early period of great activity, which rises to a maximum usually between the second and fourth years after planting and gradually declines as the soil conditions become more normal. The presence or absence of rubber trees in a clearing would not affect this, the time when the attack reaches its peak depending on the time of clearing and burning, and not on the time of planting.

The results of the experiments lend an altogether new significance to wind-borne infection (by spores) of the roots of jungle stumps after felling. No doubt remains that spores capable of germination under suitable conditions are released in great numbers and are widely distributed by the wind. Until, however, it has been shown that the spores are able to withstand considerable desiccation, it is advisable to direct control measures so as to deal with infection developing chiefly from vegetative sources present in the jungle before clearing and stimulated into activity by the clearing and burning. The best and cheapest methods of planting are considered to be in descending order of merit: (1) planting under uncleared conditions, and allowing a natural cover of secondary jungle to regenerate, (2) planting under uncleared conditions, with an artificial cover crop, (3) planting under uncleared conditions, with subsequent clean weeding, and (4) planting after all the timber above and below the soil surface has been eradicated.

Before replanting old rubber stands all infected trees should

be removed and well-defined patches of infection should be dug over, all buried timber being removed and destroyed, and the soil thoroughly exposed to the sun. Contrary to the usual opinion, soil treatments against *F. lignosus* and *Ganoderma pseudoferreum* may run concurrently.

As regards curative treatment, great emphasis is laid on the impossibility of planning adequate measurements in any given area until a tree-to-tree inspection has been made and the magnitude of the task correctly assessed. It was definitely ascertained that a 2 per cent. aqueous solution of copper sulphate kills the mycelium of *F. lignosus* provided that the two come into contact. This treatment applied periodically to the roots during the first four or five years after planting prevents the development of an attack on healthy trees.

Laboratory investigations [which are described] showed that the macroscopical vegetative characters of the mycelium isolated from the fructifications, rhizomorphs, and diseased wood were identical; the mycelium from spore cultures was very similar, but grew rather more slowly and produced much aerial growth. Rhizomorphs and fructifications were obtained experimentally from naturally infected material. The most profuse rhizomorph formation took place in the absence of light; in the light there was a tendency to form fructifications which produced spores even in very early stages of development.

A bibliography of 22 titles is appended.

NAPPER (R. P. N.). **A scheme of treatment for the control of Fomes lignosus in young Rubber areas.**—*Journ. Rubber Res. Inst. Malaya*, iv, 1, pp. 34–38, 1932.

The author proposes a new scheme of treatment against *Fomes lignosus* on young *Hevea* rubber based on the results of his recent observations on the disease in Malaya [see preceding abstract]. It has been tested experimentally and is now recommended for use on estates.

Every tree should first be examined at the collar, for a couple of feet along the laterals, and for six to eighteen inches (according to size) down the tap root. If there is any trace of *F. lignosus* the tree should be marked for treatment. Trees which are seen to be diseased without root examination should be removed with all their roots. If the hole so left is not to be replanted, a trench two feet deep by a 'changkol' [native spade] wide should be dug round it outside the radius of the roots and beyond the source of infection, the infected site being first dug over to a depth of two feet and thoroughly exposed to the sun. The trench must be regularly cleaned out. If the hole is to be replanted, the site should be dug over to a depth of three feet, eight feet round the site of the tree, removing all underground wood very carefully. A trench 15 to 20 feet square should be made round the diseased area, and the soil between this trench and the deeply dug area should be dug and roots removed to a depth of eighteen inches, any more deeply buried timber exposed during the operation being also extracted. The central hole should be drenched with 5 galls.

of 2 per cent. copper sulphate one month after digging. Liming is considered to be a waste of time and money.

Trees on which the presence of the disease is only detected on examining the roots should be treated by removing as much as possible of the external mycelium and applying 1 gall. of 2 per cent. copper sulphate to the collar and to all infected surfaces of the roots. The source of the mycelium, if found, must be removed. As the mycelium lives epiphytically on the bark for some time before penetration occurs, it should be possible to prevent healthy trees from attack by applying the treatment at intervals shorter than the time required for the mycelium to penetrate. Intervals of two or three months are sufficient even in heavily diseased areas. Two or three treatments at such intervals may be necessary to gain control over a well-established attack, while in extreme cases two further treatments at intervals of six months may be required to keep the incidence low until the activity of the fungus has abated. If the establishment of fresh infections can be prevented until this natural abatement takes place (usually in the fifth or sixth year) and until the trees are old enough to offer a determined resistance, then successful control will have been obtained.

The costs for each application at the experiment station concerned (which is on easily worked, sandy soil), including labour and material, but not supervision, were as follows: tree-to-tree inspection (100 trees per acre) 15 to 20 cents [100 cents = Straits dollar = 2*s.* 4*d.* at par] per acre for 2-year-old trees, and 30 to 50 cents per acre for 3-year-old trees. In unstumped areas the treatment of trees not requiring root examination cost 70 to 100 cents per tree, the figure for the stumped areas being 60 to 90 cents. The treatment of trees requiring root examination cost 6 to 8 cents per 2-year-old tree, and 6 to 11 cents per 3-year-old tree.

CORNER (E. J. H.). **The identification of the brown-root fungus.** —*Gardens' Bull. Straits Settlements*, v, 12, pp. 317–350, 1 pl., 8 figs., 1932.

The author states that a careful study of the fruit bodies [considerable details of which are given], supported by numerous examinations of diseased material in Malaya and from Ceylon, has established the fact that the brown root rot of rubber trees is caused not, as is usually believed, by *Fomes lamaensis* [*R.A.M.*, xi, p. 72], but by a distinct, although closely allied, species which he considers to be new to science and names *F. noxius*. The same species was also found to be associated with the stem rot of the oil palm (*Elaeis guineensis*) recently described by Thompson [ibid., xi, p. 105], and although specimens were not examined, it is presumed that it also is the cause of the brown root rot of the tea bush formerly attributed to *F. lamaensis* [ibid., x, p. 345]. The error is traced to a mistaken identification by Lloyd of specimens of the brown root rot fungus of Ceylon, sent by Petch, as *F. lamaensis*. The evidence collected so far indicates that *F. noxius* is a facultative parasite, probably widely spread in Africa and in the East, growing mainly in open situations, rarely, if ever, in the

deep forest, while *F. lamaensis* is a saprophyte in the forest, and is very rarely found under estate conditions in Malaya.

Morphologically, *F. noxius* differs from *F. lamaensis* in having wider hyphae, in the absence of hymenial setae, and in the structure of its upper surface. A detailed description [in the form of a comparative table] is given of the structure of the fruit bodies of these two species, and also of the allied *F. pachyphloeus* [ibid., xi, p. 613], in which a variety is distinguished and described under the name *hispidus* n. var. A new variety is also proposed for *F. lamaensis*, for which the name *secedens* n. var. is suggested. Latin diagnoses of all the fungi dealt with are appended. The fruit bodies of *F. noxius* are degenerate in type, and are preceded even on vertical surfaces by a resupinate *Poria* stage of varying extent, while on vertical surfaces the fruit bodies of the other two species are preceded by a typical primordial knob without a *Poria* stage. In none of the three species can detached fruit bodies survive desiccation even if only for a few days.

So far *F. pachyphloeus* has not been found causing disease in estates of Malaya.

Morrow (Marie B.). **The soil fungi of a Pine forest.**—*Mycologia*, xxiv, 4, pp. 398–402, 1932.

This is a briefly annotated list of 13 genera and 30 species of fungi which were found in the soil of a pine-oak forest in Bastrop County, Texas. Nearly two-thirds of the species belong to the genera *Penicillium* and *Aspergillus*.

Costantin (J.). **La mosaïque de la Canne à Sucre. (Enseignements découlant de sa récente histoire.)** [Sugar-cane mosaic. (What its recent history has taught us.)]—*Agron. Colon.*, xxi, 176, pp. 41–51, 1932.

After a brief historical review of the first discovery and spread of sugar-cane mosaic in various cane-growing countries, the author gives an outline of the different methods which have been suggested and tried for its control, of which the introduction of mosaic-resistant or -tolerant Java canes and their hybrids (P.O.J. canes) has been the most successful. In his opinion this effect is due chiefly, if not exclusively, to the fact that the material from which these canes have been evolved is of mountainous origin, and again supports his views of the curative effect on a wide range of plant diseases of cultivation and breeding at high altitudes [cf. *R.A.M.*, x, p. 454; xi, p. 261, *et passim*].

Costantin (J.). **Hérédité montagnarde acquise par la Canne à Sucre.** [Mountain heredity acquired by the Sugar-Cane.]—*Comptes rendus Acad. des Sciences*, cxcv, 5, pp. 345–347, 1932.

Recent studies on the hereditary resistance to certain degenerative diseases acquired by mountain-grown sugar-canes are briefly summarized [see preceding abstract], and attention is drawn to the correlation existing between this property and thinness of the stems, earliness of ripening, and a low sugar production.

Booberg (G.). **De bergbibitaanplant op Java.** [The cultivation of mountain setts in Java.]—*Arch. voor Suikerind. Nederl.-Indië*, Deel ii, xl, 37, pp. 761–767, 2 diags., 1932.

Sereh disease of sugar-cane being no longer of any practical importance in Java owing to the extended cultivation of the highly resistant P.O.J. 2878 variety [*R.A.M.*, ix, p. 161; x, p. 299], the area occupied by the hill nurseries whence guaranteed planting material was supplied to plantations in the plains [ibid., vii, p. 403] has sunk from 11,500 hect. in the years immediately preceding 1926 to 129 hect. in 1932.

Work connected with insect and fungus pests and their control. —*Rept. Agric. Dept. St. Kitts-Nevis, 1931*, p. 6, 1932.

In St. Kitts, West Indies, the position as regards gumming disease of sugar-cane [*Bacterium vascularum*: *R.A.M.*, viii, p. 464] is now satisfactory, the two chief varieties grown, B.H. 10(12) and S.C. 12/4, being highly resistant. Small markings were present on the leaves of P.O.J. 2878 at the Experiment Station, but no stem infection was observed. On B. 726, however, leaf symptoms were fairly general, and plantings of this variety will not be extended until more has been learned about its resistance. B. 417, B. 381, B. 374, and G. 119 appear to be very resistant.

Campos Goes (O.). **A doença da raiz da Cana em Pernambuco.** [The root rot of Sugar-Cane in Pernambuco.]—Reprinted from *Bol. Sec. Agric.*, 43 pp., 1932.

After a description of the external and internal symptoms of root rot of sugar-cane in Pernambuco, Brazil, the writer proceeds to a critical examination of the various factors implicated in this disease. The foremost cause of the condition would appear, from these investigations, to be the unfavourable constitution of the soil in the affected area, the roots of the plants being asphyxiated and injured by the compact, hard, and stony consistency of the ground and subsoil. The consequent metabolic disturbances are accompanied by reduced root formation, atrophy, splitting of the cane, and death of the leaves and stems. All other agencies (fungi, nematodes, toxic soil substances, and the like) are either absent or of minor importance in the districts under observation.

The condition has not been proved to be infectious, but it is more difficult to control than mosaic in Pernambuco, where it is believed to have existed for some time, affecting the Manteiga and other local varieties. The damage caused by the root rot complex is very severe and likely seriously to impair sugar production. Prophylactic measures should include rational preparation of the soil and the development of resistant varieties.

Guba (E. F.). **Monograph of the genus Pestalotia. Part II.**—*Mycologia*, xxiv, 4, pp. 355–397, 4 figs., 1932.

In this second part of his monograph of the genus *Pestalozzia* [*R.A.M.*, viii, p. 605], the author describes 45 further species. In a foreword he states that the different species can be adequately defined for monographic purposes on the basis of their morphological and macroscopical characters. A cursory review of the

relevant literature leads him to believe that very little, if any, importance is to be attached to published reports of the parasitism of species of *Pestalozzia* on plants, since, as a rule, they are found in organs that have perished from other causes, and are usually associated with other parasites or saprophytes. In his opinion, the interest presented by the genus is mostly taxonomic. A key to the identification of 73 species hitherto discussed in these studies is appended.

BUTCHER (R. W.). **Contribution to our knowledge of the ecology of sewage fungus.**—*Trans. Brit. Mycol. Soc.*, xvii, 1–2, pp. 112–124, 1 pl., 1932.

In this paper the author discusses in some detail the ecological conditions which, in English rivers and streams, govern the appearance and development of species of the Schizomycetes and true fungi composing the community of polysaprobic micro-organisms commonly known in all sewage engineering works as the 'sewage fungus'. The only two species of fungi so far found in English and Irish running waters are *Leptomitus lacteus* [*R.A.M.*, x, p. 680] and *Fusarium aquaeductum* (Radl. & Rabenh.) Sacc. The first forms mycelial tufts of a cotton wool-like context; it occurs in waters containing highly diluted, decomposed organic matter, such as, for instance, those of the river Trent below a beet sugar factory in 1927, when the season was exceptionally wet and the river remained very full and flooded throughout the season. The second occurs chiefly in acid waters, and gives a growth similar to that of *L. lacteus* but coarser, less mucilaginous, and frequently of a pink tint. Both fungi are stated to be found in Great Britain only under somewhat exceptional circumstances.

HOPKINS (J. C. F.). **Leaf curl of Tobacco in Southern Rhodesia.** —*Rhodesia Agric. Journ.*, xxix, 9, pp. 680–686, 1 pl., 1932.

Since Storey's observations on leaf curl of tobacco in Southern Rhodesia [*R.A.M.*, xi p. 676], serious outbreaks of the condition locally known as 'crinkle' have been reported from various parts of the Colony and diagnosed, by comparison with Storey's photographs, as identical with the Amani curl disease [ibid., xi, p. 76]. With a view to explaining the occurrence of sudden epidemics of 100 per cent. leaf curl in early tobacco plantings, a search was made among the previous year's plants that had escaped the plough, resulting in the detection of numerous 'suckers' showing the typical symptoms of the disease and bearing hundreds of insects in process of breeding.

The following experiment was carried out in order to verify Storey's conclusions. Tobacco seedlings, raised from seed under insect-proof conditions, were potted out in rich soil in a fumigated, screened greenhouse and covered with Dietz lamp glasses, into which whiteflies (Aleurodidae) from leaf curl plants were introduced, three days later, at the rate of 25 per plant. Ten plants were grown under lamp glasses without whiteflies and served as controls. The lamp glasses were removed after a week and the seedlings washed with 1 in 250 nicotine and soft soap and replaced in the greenhouse. A fortnight later some of the infected plants

showed clearing of the leaf veins and slight curling of the midribs and laminae. Within three weeks eight of the ten treated plants exhibited the typical symptoms of leaf curl, including curling of the foliage, thickening of the veins, and large, leafy outgrowths (enations) from the lower sides of the veins. All the controls remained healthy.

SMITH (K. M.). **Studies on plant virus diseases. XI. Further experiments with a ringspot virus; its identification with spotted wilt of the Tomato.**—*Ann. of Appl. Biol.*, xix, 3, pp. 305–330, 5 pl., 7 figs., 1932.

This is an account of the author's further investigation of the ring spot virus of *Solanum capsicastrum* [*R.A.M.*, x, p. 614], and of the experiments in which he established the transmissibility of this disease by *Thrips tabaci* [ibid., x, p. 694]. The latter part of the work indicated that previously non-infective larvae can transmit the virus only after the lapse of five days from the moment they are placed on the source of infection, and also established the fact that non-infected adult insects cannot pick up the virus *de novo*. It also tends to throw doubt on the author's previous experiments implicating *Myzus persicae* as an occasional transmitter [ibid., x, p. 615], since they did not preclude the possibility of the entrance of some infective thrips to the plants.

Cross-inoculation experiments [details of which are given] proved the identity of the *S. capsicastrum* virus with the spotted wilt of tomatoes recently described from Cardiff [ibid., x, p. 694] which is considered to be identical with the Australian form of this disease [ibid., xi, p. 549]. It is believed highly probable that spotted wilt has been present in the British Isles for some years, and has been at times recorded as tomato mosaic, streak, or stripe. A study of the host range of this virus showed that all the species of Solanaceae tested, twenty in number, and including potato, tobacco, chilli pepper, eggplant, and petunia, are susceptible to it, and it was also transmitted to lupins, dahlias, asters, zinnias, and plantains (*Plantago*).

A comparative study of some of the properties of the spotted wilt virus and those of a tomato virus of the stripe or mosaic type with which it is associated in the plants, showed that while the former does not filter through an L_1 Pasteur-Chamberland candle, and loses its viability after four hours' ageing *in vitro*, the latter passes through all grades of these candles up to L_{13}, and remains viable for many weeks under similar conditions. The latter virus is also much more infective than the former, the infective power being of the same order as that of the tobacco mosaic viruses.

KOSTOFF (D.) & KENDALL (J.). **Origin of a tetraploid shoot from the region of a tumor on Tomato.**—*Science*, N.S., lxxvi, 1963, p. 144, 1932.

Out of 120 tomato plants inoculated internodally in the spring of 1931 with *Bacterium tumefaciens*, 109 developed tumours. When the stems were cut off above the tumours shoots developed in some cases from the latter. These shoots, together with a small portion of the stem and the tumour, were removed and rooted in

soil. One of the resulting plants proved to be tetraploid. All the roots from this shoot, which developed at 3 cm. and more above the point of origin from the tumorous stem, showed 48 somatic chromosomes compared with 24 in the original plant. On separation and transplantation two months later, the shoot developed into an apparently normal plant, except for the slightly larger flowers.

Polyploidy in this case is evidently not a cause of tumour formation, as is sometimes suggested.

Weber (G. F.), Hawkins (S.), & Kelbert (D. G. A.). **Gray leaf-spot, a new disease of Tomatoes.**—*Florida Agric. Exper. Stat. Bull.* 249, 35 pp., 14 figs., 1932.

An expanded account is given of the grey leaf spot disease of Florida Globe, Marglobe, and Earliana tomatoes caused by *Stemphylium solani* [*R.A.M.*, xi, p. 771], the losses from which were estimated at 5 per cent. of the crop of 1925, 1926, and 1927, 15 per cent. in 1928, 10 per cent. in 1929, and 2 per cent. in 1930 and 1931. Natural infection by *S. solani* has been found on *Physalis pubescens*, eggplant, and [chilli] pepper, which suffered considerable defoliation, as well as on the weeds *Solanum aculeatissimum*, *S. blodgettii*, and *S. verbascifolium*. A number of other Solanaceae [which are listed] proved susceptible in inoculation experiments, including *S. carolinense*, *S. nigrum*, and potato.

Discussing the taxonomy of the causal organism, the authors state that it was placed in the genus *Stemphylium* rather than in *Alternaria* on account of its beakless spores and failure to form spore chains [ibid., xi, p. 393]. During the seven years in which this fungus has been cultured on various nutrient media, no trace of saltation has been observed.

Natural infection of tomato seedlings takes place on emergence from the soil and may continue throughout the life of the plant, all the aerial parts of which except the fruit are liable to attack. The hyphae penetrate the epidermis between the cells or through the stomata. Visible symptoms of infection appear in about three days. The short, erect conidiophores protrude from the stomata or directly through the epidermis of the killed cells, conidia being produced at their tips within a few hours. The spores have been found to retain their viability for periods of 19 months, and to be disseminated over long distances by the wind.

Lindeijer (Egbertha J.). **De bacterie-ziekte van de Wilg veroorzaakt door Pseudomonas saliciperda n. sp.** [The bacterial disease of the Willow caused by *Pseudomonas saliciperda* n. sp.]—Thesis, University of Amsterdam (Hollandia-Drukkerij, Baarn), 82 pp., 4 pl., 4 figs., 1932. [English summary.]

After an exhaustive description of the external and internal symptoms of the bacterial disease affecting willows (*Salix alba*, *S. amygdalina*, and *S. purpurea*) in Eemland, Holland, the writer fully discusses her standpoint in regard to the connexion between this disease and that attributed by Day in England to *Bacterium salicis* [*R.A.M.*, xi, p. 411].

A comparison of the external and internal symptoms in both countries indicates the substantial identity of the two diseases, though certain minor differences are apparent. Day [ibid., iv, p. 322] and the writer both observed, as the first symptom of attack, the sudden wilting and death of the leaves and tops of the young shoots on one or more branches. The former, however, did not mention the feather-like shrivelling up towards the midrib of the leaves near the seat of infection. Day's observation that infection occurs primarily on the overshadowed parts of the crown was not confirmed by the writer, but it is true that the insect vector of the disease, *Cryptorrhynchus lapathi*, prefers the shaded portions of the tree; hence the importance of wide spacing as a control measure. In England the death of the branches ceased in July, whereas in Holland it continued throughout the summer until September. The exudation of bacterial slime was only detected by Day in May and June on the sites of fresh insect injuries, while the writer also noticed this symptom from May till the end of August in the axils or under the points of insertion of small lateral twigs, in leaf scars, and in cortical fissures. Possibly meteorological differences in the two countries may account for these discrepancies. The cortical discoloration associated with the bacterial disease in Holland is not mentioned by Day, and may have been obscured by the simultaneous presence in the affected English trees of *Cytospora chrysosperma*. According to Day, infection spreads more rapidly down the trunk than upwards, but this difference was not apparent in the Dutch trees examined.

The bacterium isolated by the writer from diseased material and successfully inoculated into healthy trees was found to differ in various respects from *Bact. salicis*, and as it was impossible to obtain a culture of the latter for comparison, the Dutch organism is regarded as distinct on the basis of the under-mentioned and other disparities and named *Pseudomonas saliciperda* n. sp. The average length of the latter is 1·7 μ compared with 0·8 to 1 μ for *Bact. salicis*. The granular consistency of the colonies, the dendriform outgrowths, and the fimbriate edges characteristic of Day's organism were absent in the author's cultures of *P. saliciperda*. The colour of *Bact. salicis* on potato is yellow and it turns the medium brown, while *P. saliciperda* is dirty white to lead-grey and turns the potato the latter colour; starch is utilized by Day's organism but not by the writer's. In further contrast to *Bact. salicis*, *P. saliciperda* is Gram-negative and reduces nitrates to nitrites. The optimum temperature for the growth *P. saliciperda* is 25° to 30° C.

The differences between the Dutch and the English organisms do not, in the writer's opinion, prove that different diseases are involved, especially as only one of Day's inoculation experiments with *Bact. salicis* gave positive results. Possibly his tests were not performed with pure cultures of the organism, or he may have been working with *P. saliciperda* but omitted to describe all its characters.

Inoculation experiments showed that *P. saliciperda* makes rapid progress in the trees, having already penetrated to the roots when the first external symptoms become apparent. The beetle *C.*

lapathi was invariably found near naturally diseased trees and traces of its feeding could be seen both on healthy and diseased twigs. Experiments showed that, in the course of feeding, the insect wounds the bark and penetrates the wood; the bacteria are thus readily transferred from diseased to healthy vessels and the disease perpetuated. When a beetle was allowed to feed first on infected and then on healthy twigs, the latter developed the typical discoloration of the wood and some of the vessels were found to be swarming with bacteria.

P. saliciperda is a vigorous parasite in Holland and no evidence was obtained that its activity is restricted to trees growing under unfavourable conditions; the most severe symptoms were frequently found on vigorously growing willows. The removal of such sources of infection as old, semi-decayed pollard willows is advocated by Day and this measure must be approved on general grounds, though there is no reason to suppose that trees of this kind are particularly liable to attack. In order to check the further spread of the bacterial disease in Holland, means must be sought of combating the insect vector, and a study should also be made of the possibilities of control through varietal resistance.

NĚMEC (B.). **Jaraia salicis.**—*Studies Plant Physiol. Lab. Charles Univ. Prague*, iv, 1, pp. 1–21, 24 figs., 1931. [German, with English summary.]

A detailed account is given of the Saprolegniaceous fungus, *Jaraia salicis*, originally described by the writer (*Bull. Int. Acad. Bohem. Prague*, 1913) as a parasite of the root tips of willows (*Salix purpurea*, *S. viminalis*, *S. amygdalina*, and *S. fragilis*), on which it causes swellings, in Czecho-Slovakia.

The hyphae are intercellular and contain numerous small, lenticular, granular nuclei. Zoosporangia are formed in short chains, the uninuclear zoospores being differentiated by a process of cleavage and escaping through several short exit tubes. The multinucleate antheridia and oogonia both arise terminally on special hyphae. Fertilization by a simple tube was observed and the male and female nuclei are stated to fuse in pairs. The uninuclear, uniguttulate, multiple oospores are originated by furrows spreading radially outwards from the central vacuole, the segments rounding off and developing a thick, smooth wall. The reduction division probably occurs at the germination of the oospore. Although the mode of oospore development is not altogether typical of the Saprolegniaceae, the author thinks the willow fungus should be referred to this family, possibly as the representative of a special sub-family.

VOGLINO (P.). **Intorno ad un deperimento del Pioppo canadense.** [On a die-back of Canadian Poplar.]—*La Difesa delle Piante*, ix, 3, pp. 33–34, 1932.

Young branches of Canadian poplars [*Populus canadensis*] from various parts of Italy have been found with lesions of a cankerous nature, measuring up to 12 or 15 cm. long and about a quarter as much broad. They were covered by a purplish or violet crust consisting of masses of globose, slightly echinulate, amethyst-

coloured conidia on short, densely crowded conidiophores. Morphologically, the fungus resembled a *Tuberculina*. The condition is considered to be only a transitory effect of no pathological importance, the organism found on the lesions being probably a saprophyte.

VOGLINO (P.). **La marcescenza del fusto nella Araucaria imbricata.** [Trunk rot of *Araucaria imbricata*.]—*La Difesa delle Piante*, ix, 2, pp. 17–20, 4 figs., 1932.

Young *Araucaria imbricata* trees growing in a nursery in Italy became affected by a serious die-back. The leaves turned yellow and the trunk became abnormally swollen for a few centimetres above the collar. The bark was readily detached or shredded, and a colourless, viscid liquid oozed out.

The diseased material contained a dense weft of fuliginous hyphae passing between the necrosed cells of the periderm and phellogen and between the phloem and wood. Conical, ostiolate pycnidia, isolated or arranged in groups of two to four, were visible near the top of the swollen part and towards the base of the leaves. They were pluriloculate, and contained oblong-fusoid, hyaline pycnospores, 24 to 27 by 5 μ, borne on cylindrical stalks measuring 12 to 14 by 5 μ.

The fungus is referred to the genus *Fusicoccum* and is named *F. araucariae* n. sp.

Associated with the thick, dark mycelium, dark stromata were noted especially at the base of the leaves, bearing 2 to 4 spheroidal perithecia with elongated, clavate asci measuring 140 to 160 by 15 μ and containing 8 subdistichous, elliptical or fusoid-elongated ascospores, 20 to 25 by 8 μ. In one stroma a pycnidium occurred alongside a perithecium containing ascospores. The perithecial fungus is named *Cryptosporella araucariae* n. sp.

In hanging drop cultures the pycnospores germinated rapidly at 12° to 20° C.; after twenty days at the outside pycnidia with mature pycnospores had formed. In agar decoction germination was slower, but the stromatic masses containing pycnidial cavities were more numerous. After two months a perithecial stroma was observed with developing asci of the *Cryptosporella* type. The *Cryptosporella* spores also germinated in the decoctions, but only stromatic masses were obtained, without any special fructifications.

It is concluded that the *Cryptosporella* is the perfect stage of the *Fusicoccum* and Latin diagnoses are given of the new species.

VAN VLOTEN (H.). **Rhabdocline pseudotsugae Sydow, oorzaak eener ziekte van Douglasspar.** [*Rhabdocline pseudotsugae* Sydow, the cause of a disease of Douglas Fir.]—Thesis, Wageningen Agricultural College (C. A. Mees, Santpoort), 168 pp., 4 col. pl., 43 figs., 1 map, 1932. [German summary.]

A comprehensive survey is given of the writer's continued investigations on the disease of Douglas fir (*Pseudotsuga douglasii* and *P. glauca*, considered by some to be only varieties of *P. taxifolia*), caused by *Rhabdocline pseudotsugae* in Holland [*R.A.M.*, x, p. 140].

It was found impossible to grow the fungus (which can persist for months in the living cells of the host without killing them) on

artificial media. *R. pseudotsugae*, therefore, must be ranked among the obligate parasites, such as the Uredineae and Erysiphaceae. Unlike the latter, however, the Douglas fir parasite does not form spores for nearly a year after infection, and then only if the diseased needles remain on the tree; the apothecia do not develop, as they do in *Lophodermium pinastri* on *Pinus sylvestris*, on fallen needles.

Infection occurs by the early development of a narrow infection hypha from the germ-tube of the ascospore, which penetrates the cuticle apparently by mechanical pressure. Both surfaces of the needle can be penetrated. The cells are entered and may eventually be filled with hyphae. Only the chlorenchyma is attacked, the endodermal cells and central cylinder remaining free from invasion. Later on an intercellular mycelium develops and gives rise to the apothecial stromata, the development of which, and of the asci and spores, is very fully described. The author does not consider that the occurrence of a conidial stage in the life-history has been clearly established.

The factors determining resistance to *R. pseudotsugae* are not yet completely understood. A. Henry and M. G. Flood (*Proc. Roy, Irish Acad.*, xxxv, p. 67, 1918–20) detected a marked difference in odour between the needles of the resistant Pacific Coast, Oregon, or green Douglas fir (*P. douglasii*) and those of the susceptible Rocky Mountains, Colorado, or blue variety (*P. glauca*), the latter containing a high percentage of turpentine and various esters which are absent from the former. Anatomical differences in the structure of the needles also occur, those of *P. glauca* being stiffer, with a well-developed hypoderm and numerous idioblasts, while in *P. douglasii* the hypoderm is inconspicuous and the idioblasts absent. The fungus can only penetrate young needles, older ones acquiring resistance through the formation of cutinized layers and the secondary thickening of the outer wall of the epidermis. In greenhouse tests a large number of two-year-old seedlings of *P. douglasii* were successfully infected by *R. pseudotsugae*, but this need not necessarily be interpreted as pointing to the existence of a biologic form of the fungus. Both the green and the blue varieties contain individuals in which the parasite develops without killing the host cells, while in others a few needle cells die shortly after penetration by the hyphae, the growth of the latter being arrested. In this connexion it is a striking fact that no cork formation takes place in the needles of resistant trees, the sole reaction to invasion being that of the living chlorenchyma cells, expressed by the exudation of intercellular drops. No other hosts than the Douglas fir are known.

The view that *R. pseudotsugae* was introduced into Germany from Scotland or Holland [*R.A.M.*, xi, p. 141] by natural means cannot be accepted on the basis of the author's observations, which render it highly improbable that the ascospores of the fungus can travel through the air for such long distances. It is considered much more likely that infection reached Holland with a consignment of trees from a German nursery. Stringent nursery precautions are, in fact, the strongest safeguards against the further dissemination of *R. pseudotsugae*.